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THE SURGICAL TREATMENT OF FACIAL PARALYSIS BY NERVE ANASTOMOSIS.[1]

WITH THE REPORT OF A SUCCESSFUL CASE.

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PARALYSIS resulting from disease or injury of no other individual nerve leads to a deformity more distressing than that consequent upon the loss of function of the N. facialis.

For several years it has been known, chiefly from experimental observations, that, after the division of a peripheral mixed nerve, the transplantation of its distal severed end into the trunk of a neighboring nerve of like nature might result in complete restoration of function. In an occasional authenticated case in man, a similar anastomosis between a paralyzed and an intact nerve has resulted in recovery.* It was thus

[1] Read before the Philadelphia Neurological Society, February 24, 1903.

* This, I believe, was first conclusively demonstrated by the oft quoted case of Sick and Sänger. (Heilung einer in Folge traumatischen Defects bedingten Lähmung des Radialis durch Vernähung des peripheren Endes dieses Nerven mit dem Medianus, Langenbeck's Archiv für klinische Chirurgie, 1897, Band liv, p. 271.) Sick grafted the distal stump of a paralyzed musculospiral nerve into the neighboring intact median. The patient ultimately regained perfect motor control with coördination in the groups

demonstrated that cortical impulses travelling over new paths could in favorable cases be made to reach a group of muscles whose proper neural connections had been irreparably severed, and that normal coördinated movement might result and sensory stimuli as well be properly located and interpreted.

On *a priori* grounds such a transference of functional activity from one purely efferent nerve to another would appear more simple and its accomplishment more probable than in the case of mixed nerves, conveying as they do both centrifugal and centripetal impulses. It consequently is a matter of some surprise that the attempt has not been made heretofore by many to reclaim by operative measures the sorry cases of facial paralysis by the sacrifice of a neighboring motor nerve, the loss of which would lead not only to a relatively insignificant disability, but a much less obtrusive deformity. That the spinal accessory, the hypoglossal, or a motor branch from the cervical plexus might lend itself to such an anastomosis is a natural suggestion.

Seemingly, in 1898, Dr. Faure, of the Hôpital Laënnec, made the first attempt to carry out this procedure, acting upon the suggestion of his colleague, Dr. Furet. In a patient, who for eighteen months had been afflicted with facial paralysis consequent upon a traumatic destruction of the nerve during its course through the temporal bone, an anastomosis was made between the peripheral end of the N. facialis, divided near the stylomastoid foramen, and that portion alone of the N. acces-

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of muscles presided over by both nerves, the impulses travelling by way of the median alone. Since then there have been several successful cases of this comparatively simple performance.

Still more complicated procedures have been carried out experimentally. Thus there has been a successful transference or crossing between the flexor and extensor nerves of an extremity with complete return of coördinate function, the impulse calling out flexor movements travelling from the centre over a nerve originally an extensor, and *vice versa*.

Even more remarkable has been Langley's demonstration that nerves originally subserving entirely different purposes, as the sympathetic and the pneumogastric, may be successfully crossed. He has, for example, succeeded by an anastomosis in making the vagus nerve take up the vasomotor activities of the divided and transplanted cervical sympathetic.

sorius which supplies the trapezius muscle. The operation, unfortunately, in this instance did not lead to "un résultat hereux;" but the case nevertheless was subsequently reported several times during the years 1898-1901 by one or the other of these gentlemen before the French Societies (see Historical and Bibliographical Notes) and advocated as a feasible measure. Their report by no means met with the attention in medical literature which it deserved, and the suggestion apparently was taken up by none of the surgeons interested in neurological problems.

Early in the same year, and quite independently of Foret's suggestion, Paul Manasse, working in Munk's laboratory in Berlin, instituted a series of experimental observations on nerve anastomosis (Nervenpropfung), the results of which were made public late in 1901. In five animals he divided the N. facialis at its exit from the skull, and made an end lateral suture between the stump of this nerve and the N. accessorius. Two of the cases may be regarded as failures, inasmuch as strands from the central end of the severed facial were subsequently found to have grown down and to have reunited with the peripheral segment at the site of anastomosis. In the other case, however, in which this did not occur, the straightening of the animal's face, with evidence of some motor control of the paralyzed side, the return of faradic excitability, the subsequent histological demonstration of the continuity of nerve fibrils between the two nerves across the line of suture, and the contractions in the facial muscles brought out after recovery by exposure and stimulation of the N. accessorius central to the point of anastomosis, furnished evidence sufficiently conclusive of the partial, if not complete, success of the venture.

At the same time a somewhat similar piece of work under the acknowledged stimulus of Foret's suggestion was carried out in the Otorhinological Institute of Naples by Barrago-Ciarella, the results of which were published in Italian, anticipating by a few months Manasse's paper. Three seemingly successful anastomoses were performed by him on dogs, with the return after a few months of normal electrical excitability

and voluntary motion. The central end of the divided spinal accessory was utilized in two cases and of the vagus in another. The author modestly concludes his interesting paper as follows: "Nei cani la sutura del moncone centrale dell' accessorio o del vago previamente resecati, col moncone periferico del facciale alla sua volta reciso, è suscettibile, se immediatamente eseguita, di ripristinare la funzione nei muscoli dallo stesso faccialle innervati." It must be confessed, however, in the absence of a post-mortem and histological study of these cases, and in consideration of the difficulty experienced by others in preventing reunion of experimentally divided nerves, that there is a possibility that re-establishment in continuity of the facial fibres may have occurred in these dogs.

The single instance in which the particular anastomosis under discussion has been successfully carried out on man was communicated to the Royal Society in November, 1900. Early in the preceding year, Robert Kennedy, in Glasgow, as the direct outcome of his valuable experimental work on the restoration of coördinated movements after nerve crossing, divided the N. facialis for the relief of a case of severe facial spasm, making an immediate suture between the peripheral divided end of the facial and the N. accessorius, the latter nerve having been incompletely severed at the site of anastomosis. As the result of this operation, there was at the time of Kennedy's report almost complete restoration of function in both groups of muscles temporarily paralyzed at the operation by the section of the seventh and eleventh nerves. His postoperative observations on this case demonstrated that the N. accessorius alone ultimately served as the path for transmission of impulses to both motor territories.

Unaware that there was any literature on the subject of spinofacial grafting, the suggestion for such an operation came to the writer through cognizance with Langley's experimental work on the transference of nerve function after anastomosis between the vagus and sympathetic. On the 12th of May, 1902, the case of traumatic facial paralysis here reported was operated upon, the proximal stem of the divided N. accessorius

being transferred *in toto* into the distal end of the injured and paralyzed facial. Within four months, evidence of returning control of the paralyzed muscles was appreciable, and at the time of this writing, six months after the suture, a condition approaching the normal has been re-established.

As far as I have been able to learn, Faure's unsuccessful case some months after a traumatic lesion and Kennedy's case of intentional division and immediate anastomosis with favorable result are the only instances in literature in which this procedure has been heretofore recorded.

The history of the writer's case is as follows:

The patient, a young man thirty years of age, was brought to the hospital by Dr. Ellis, of Elkton, on the 29th of March, 1902. He had received, some hours previously, a bullet wound from a .38-caliber revolver held close to the skull and discharged just behind the right ear. When first seen by the attendant soon after the injury, it was noted that there was a ragged wound of entrance at the situation of the mastoid process, and that the patient had a complete paralysis of the right side of the face. At no time was there loss of consciousness or any other symptom indicative of intracranial mischief.

Soon after his admission to the hospital, the grimy wound was thoroughly cleaned out by Dr. Mitchell and the bullet extricated from the base of the skull, where it was found mushroomed and firmly lodged in the bone. The missile had passed from behind forward through the anterior part of the mastoid process, destroying in its course the lower part of the Fallopian aqueduct and facial nerve, the tympanum and middle ear, and disorganizing to an uncertain extent the petrous portion of the temporal bone. It was evident that the N. facialis had received an irreparable injury, and was missing for a considerable portion of its course between the stylomastoid foramen and the ganglion geniculatum. A careful examination a few days later showed that the perception of taste for sweet, sour, bitter, and acid substances was abolished over the anterior two-thirds of the tongue on the right side. Motor paralysis was complete in the right side of the face and in the platysma as well, all of the muscles giving the reaction of degeneration. Bell's sign, the rolling up of the eyeball on

attempted closure of the eye, inability to distinctly pronounce the labials, lachrymation, and the other many discomforts attendant on the condition of facial palsy were present. Some hearing, to bone conduction alone, was preserved in the right ear.

It was determined to await the healing of the wound and then to make some effort to restore the motor control of the face by nerve anastomosis, and many dissections were made in the interim with this end in view. The N. accessorius was chosen as the nerve which lent itself most favorably to this procedure.

Not until the 12th of May, six weeks after the injury, when the postauricular wound had completely closed, was it deemed advisable to undertake the operation for which perfect healing seemed a *sine qua non*. By this time the patient's face had become, even during repose, much drawn to the left, and an effort to close the eye would result in the peculiar grimace characteristic of facial paralysis, with tilting up of the eyeball as shown in the photograph (Fig. 2). The sense of taste over the anterior two-thirds of the tongue had by this time largely returned, although the reaction time for the recognition of most substances was considerably slower than on the left side. His condition otherwise seemed unchanged.

May 12, 1902. Operation. Ether Anæsthesia.—The anatomical landmarks of the operative field are sufficiently well indicated in the accompanying sketch (Fig. 1), and the line of incision along the anterior border of the sternomastoid is shown by the cicatrix in one of the photographs (Fig. 3).

The N. accessorius was readily located and exposed at its point of entry into the posterior surface of the sternocleidomastoid muscle about five centimetres below the mastoid tip. The nerve consisted of one trunk, and was not split into two portions as is often the case, and as is indicated in the drawing (Fig. 1). The nerve thus exposed was not divided nor freed from its bed until the N. facialis was similarly brought to view, in order properly to estimate the length of each trunk which was requisite for suture without tension. The facial was exposed by incising the posterior border of the parotid gland in a line parallel to and directly under that of the original skin incision. Previous observations on the cadaver had demonstrated that this was a simpler method of locating the nerve than by making a deep search for the main trunk posterior to the gland. One of the two chief branches of

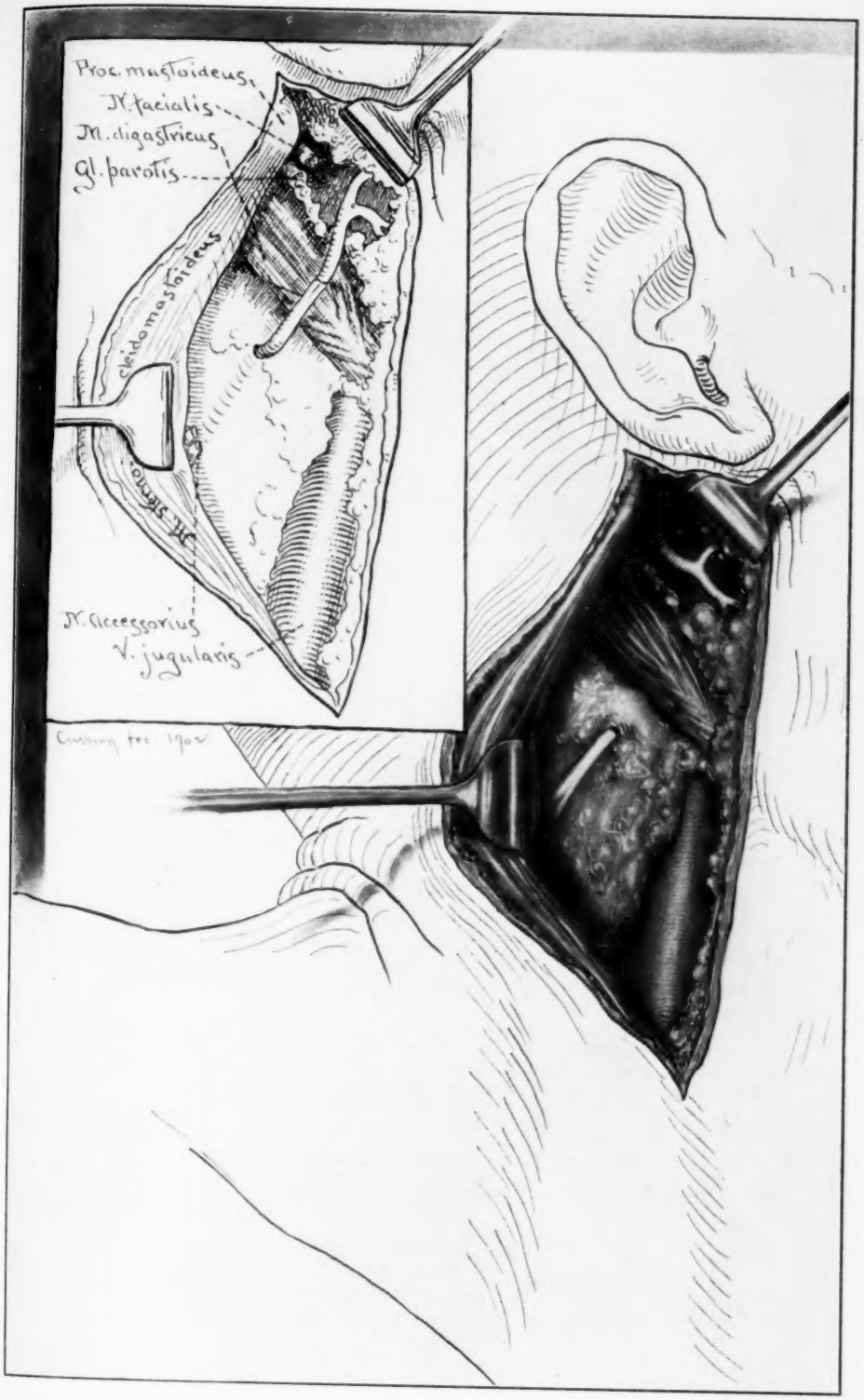

FIG. 1.—Sketch showing the anatomical landmarks of the operative field. Actual size. Outline drawing in corner indicates the position of the nerves after division and suture.

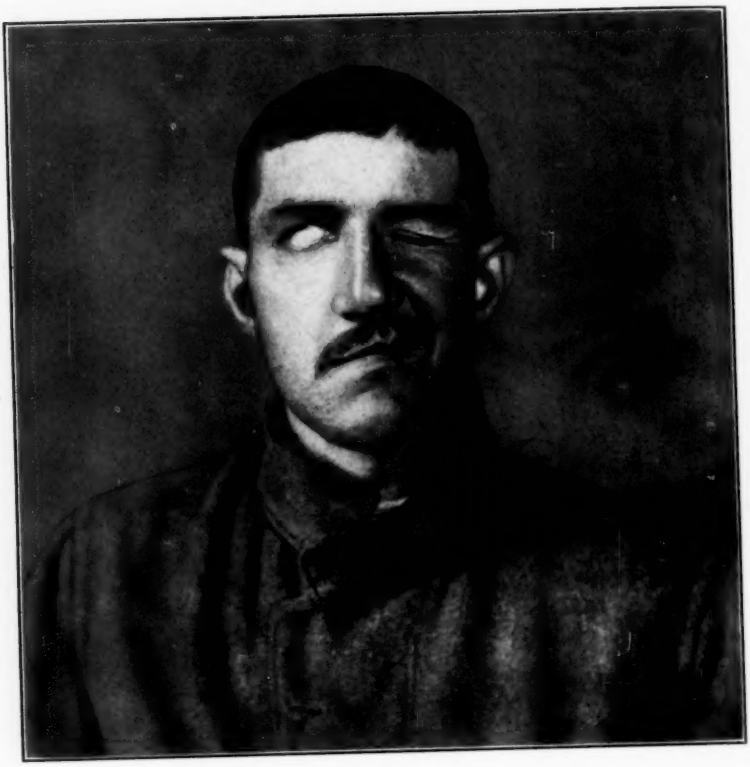

FIG. 2.—Photograph taken May 2, shortly before the operation (six weeks after reception of injury). Showing characteristic appearance on effort to close eyes. Note rolling up of eyeball, with no inhibitory droop of levator palpebræ superioris whatever. At this time, even during repose, the nares and mouth were markedly drawn to the left.

bifurcation is certain to be encountered and without injury if the incision is carefully made, and this branch can then be delicately followed back to the main trunk by blunt dissection without isolation of the nerve or the exertion of trauma which might jeopardize the success of the suture.

The facial thus exposed was squarely divided as near as possible to the scar tissue occupying approximately the site of the stylomastoid foramen. For ease of subsequent handling, a delicate split silk suture was passed through the perineural sheath of the nerve just distal to the point of proposed division. The spinal accessory was similarly handled and divided close to its point of entry into the muscle. Both nerves were dissected out together with some of the loose perineural connective tissue, only far enough, however, to enable them to be brought together over the posterior venter of the digastric muscle (see corner sketch, Fig. 1). Thus transplanted, the sheaths of the nerve stumps were sutured together at three points by means of fine curved intestinal needles threaded with the most delicate strands of split silk.

The suture looked well, the nerves remaining well approximated end to end without tension. The incision in the parotid was drawn together with three fine sutures so as to cover again the facial nerve. Complete hæmostasis had been observed throughout, as shown by the absence of blood staining of the tissues at the termination of the operation. The wound was closed with a subcuticular silver-wire suture. The healing left nothing to be desired, a barely perceptible scar representing the line of incision (Fig. 3).

Subsequent History.—Within a day or two after the operation, the patient insisted that some power of motion had returned in the eyelid, rendering its partial closure possible. In the early morning hours, after a night's rest and while lying on his back, this was especially noticeable, and it had not previously been observed. It is, of course, impossible that this could have been anything more than an inhibitory action on the part of the M. levator palpebræ superioris which was mistaken for a voluntary contraction of the M. orbicularis (pars palpebralis).* On the

* Kennedy (*loc. cit.*) noticed similarly in his case on the seventh day "that there was a very slight movement of the upper eyelid possible." I cannot believe that the transmission of motor impulses could have taken place so soon after section and suture of a nerve. Although it is not

day after the operation the patient also announced that he was no longer troubled with lachrymation, and that for the first time he could read without the annoyance of an overflow of tears; that he was less troubled with saliva, and was better able to dislodge food from his flaccid cheek. I am at a loss to explain these early subjective assurances of improvement.

On the tenth day the patient returned to his home with a small galvanic battery, and the early return of function and steady improvement in his condition are largely attributable to his perseverance in continuing his daily electrical treatment and his later exercise of the muscles before a mirror.

The notes concerning his period of convalescence, owing to infrequency of examinations, are of necessity more or less random ones.

May 25, 1902 (13 days). The patient still insists on great subjective improvement in motion of the eyelid, in diminution of lachrymation, in ability to dislodge food from his flaccid cheek; does not lose saliva and liquids from corner of mouth; can eat with fork for first time without soiling. The face while at rest certainly appears much less asymmetrical. The upper lip, previously pulled far to the left, is much less drawn. There is no evidence of "contracture" of paralyzed muscles. The palpebral cleft seems considerably less wide. At present, on attempted closure of the eye, the lower edge of the iris is completely hidden, unlike the earlier condition shown in Fig. 2.

August 1, 1902 (81 days). Patient seen at his home. Marked improvement. Facial asymmetry at rest hardly noticeable. There is considerable voluntary motion in the orbicularis (pars palpebralis) and a slight voluntary twitch of the lower lip at the

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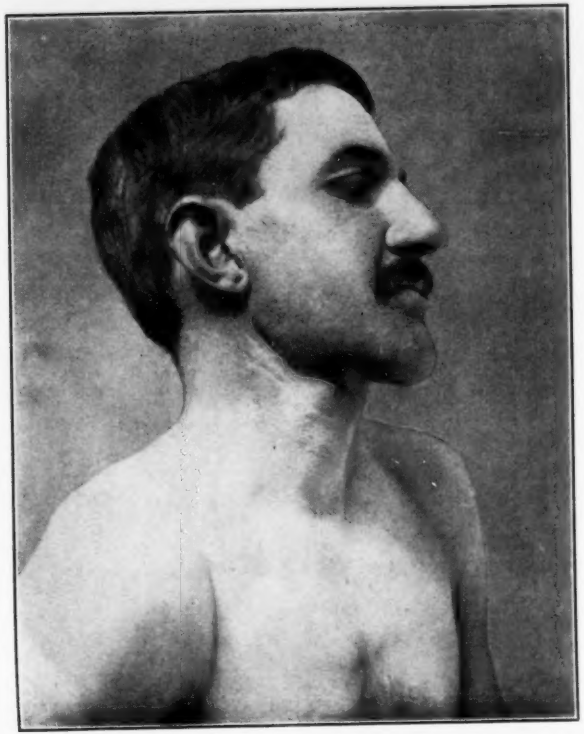
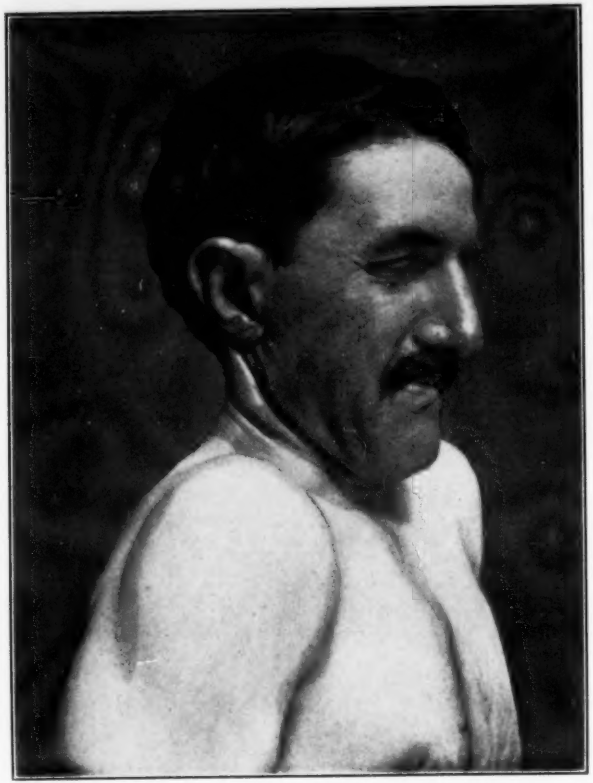
spoken of in the descriptions of injury to the facial nerve, it is not uncommon to see in cases of complete paralysis a considerable and seemingly active droop of the upper lid associated with the voluntary effort to close the eye. This movement doubtless is due to the inhibition in the activity of the third nerve supplying the levator of the lid, a muscle which normally tends to keep the eye open, and which presumably is always relaxed during voluntary closure of the lids. Sherrington has demonstrated experimentally that such an inhibitory action always occurs during motion, in the passive one of two antergic muscles.





Photographs taken September 15 (127 days).

FIG. 3.—Showing line of incision. Effort to close eye without associated movement of shoulder.

FIG. 4.—Further closure of eye and deepening of nasolabial sulcus on elevation of shoulders combined with voluntary expressional effort.

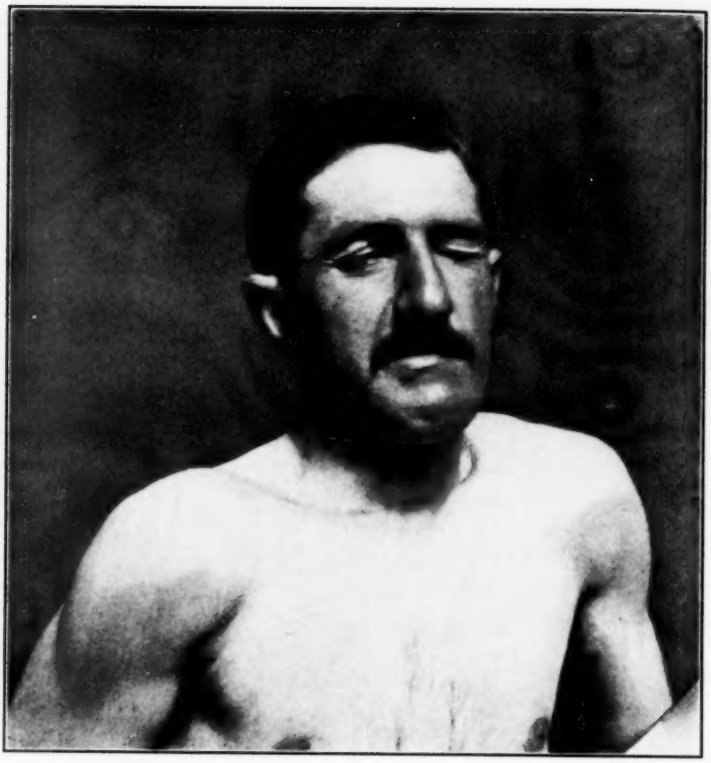


FIG. 5.—Photograph taken September 15 (127 days). Shows extent of closure of eye on partially combined effort. Eyeball rolls up.

corner of the mouth. [It is interesting to compare Kennedy's case in which the absence of asymmetry during repose (123d day) was among the first noted signs. Indication of power to make voluntary movements (172d day) and a slight movement at the angle of the mouth (190th day) are much later, but in the same sequence as in my case.]

September 1, 1902 (112 days). By letter. Announcement that since the middle of August (the 15th would have been ninety-five days) there has been a rapid improvement. According to direction, he had been galvanizing the muscles, watching his face meanwhile in a mirror, when he noticed, to his surprise, that on moving his shoulder he could bring out considerable contraction in some of the paralyzed muscles. "When I wish to laugh straight, I can help it out with my shoulder."

September 15, 1902 (127 days). Examination. (Photographs Figs. 3, 4, and 5 taken on this date.) At rest there is very slight visible deformity. The palpebral cleft is considerably wider on the right, and the absence of winking and slight droop of the lip betray the condition, though the median line of the face is no longer distorted. There is considerable voluntary control over some of the facial muscles, and this is very much exaggerated when the patient shrugs his shoulders. There is practically no co-ördination, the muscles, which have regained some power, moving all together very slightly and only on great effort unless the associated shoulder action is called out. Elevation of the shoulder alone is impossible without producing a strong contraction of the recovering facial muscles, and this contraction is sustained as long as the shoulder is held up. There is considerable power in the orbicularis, though the eye cannot be voluntarily closed even with the help of shrugging (Fig. 5). Bell's phenomenon persists. The nasolabial muscles are also responsive to volition, and the nasolabial fold is well marked during their action. It is not present during repose, showing absence of contracture.

The sternocleidomastoid and trapezius are paralyzed and give the reaction of degeneration. The patient is in no way troubled by the shoulder droop.

Electrical Examination. Galvanism.—The muscles on the right side all react to direct stimulation somewhat more lazily

than on the normal side. Indirect. Over the cicatrix on the right side, two and one-half centimetres below the mastoid process, galvanic stimulation with a moderate current gives a strong, fairly prompt contraction of all facial muscles, but elicits no response whatever in the sternomastoid or trapezius. Stimulation of the corresponding point on the normal side calls forth only a sharp contraction in the latter muscles. Galvanism of the individual branches of the pes anserinus on the right failed to elicit any contractions in their motor territories, whereas on the normal side the usual lightening contractions were readily evoked.

Faradism.—Normal responses on the left. No response whatever by direct or indirect stimulation on the right. (It is noteworthy that Kennedy observed some reaction to the faradic current as early as the forty-ninth day, although no voluntary movements were appreciable until the 172d day.)

October 6, 1902 (147 days). Seen at his home. Very slight contraction in occipitofrontalis noticed for first time. Winking reflex present, though very slight and associated with rolling upward and outward of the eyeball. Palate not symmetrical; on phonation the left arch is higher and narrower than the right.

October 27, 1902 (168 days). Photographs (Figs. 6-11) taken on this date. Considerable improvement. Facial asymmetry at rest, barely appreciable. Some coördination of expressional movement is present. Patient can to a slight extent dissociate movements of eye, nose, and mouth. Considerable freedom of facial movement without calling forth shoulder action. Reverse not the case. Eye cannot be quite closed by voluntary effort (Fig. 7). Whistling impossible as yet, but lips can be puckered to some extent (Fig. 8). Pronunciation of labials perfect. Contraction of platysma possible (Fig. 7). Elevation of arm and shrugging of shoulder still call forth general contraction of facial muscles which cannot be controlled, and which is sustained. The mere elevation of the arm, held supported without effort on the patient's part, causes some contraction of the face which he is unable to relax (Fig. 9). With the arm in this position, however, extreme voluntary effort on the patient's part to contract the facial muscles increases the action already called forth (Fig. 10). If in addition to this the support is removed from the arm

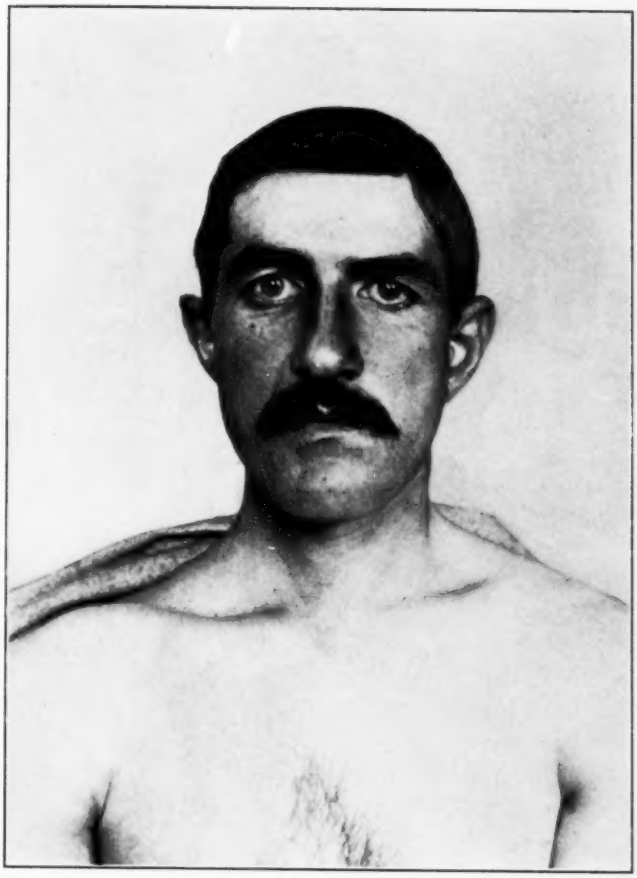


FIG. 6.—October 27, 1902 (168 days). At complete rest. Only evidence of facial asymmetry shown in slightly wider palpebral cleft on right and in slight droop of lip on same side. Note prominence of clavicle and droop of shoulder.

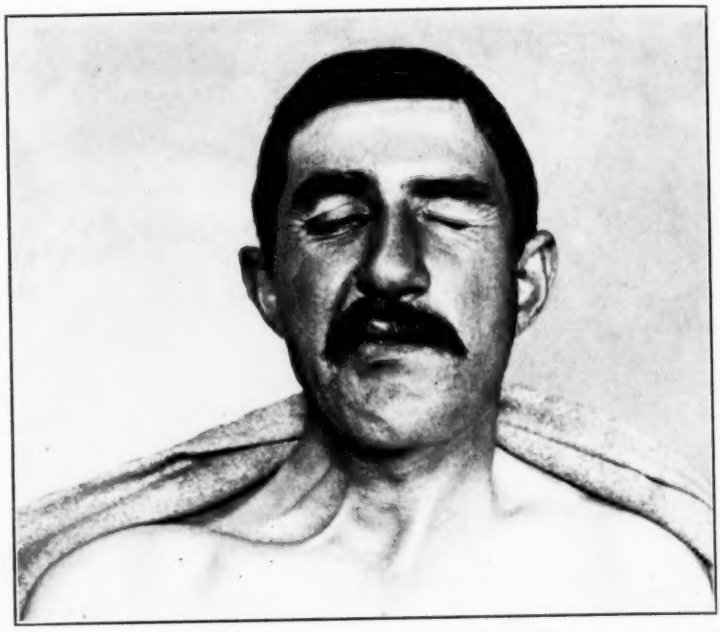


FIG. 7.—October 27, 1902 (168 days). Effort to close eye. Note that coordination is far from perfect, as nasolabial muscles, platysma, etc., are called into play, as well as orbicularis palpebrarum on opposite side. Improvement over condition of 127th day, as here no elevation of shoulders is associated. Note contraction of platysma. Palpebral cleft remains slightly open.

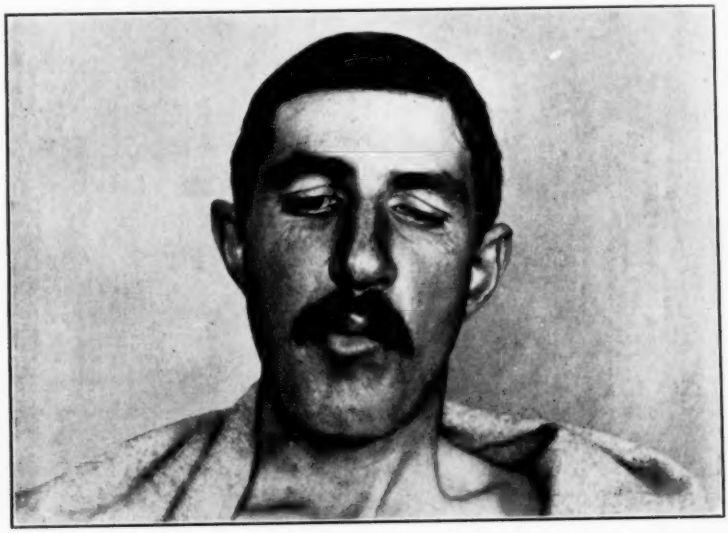
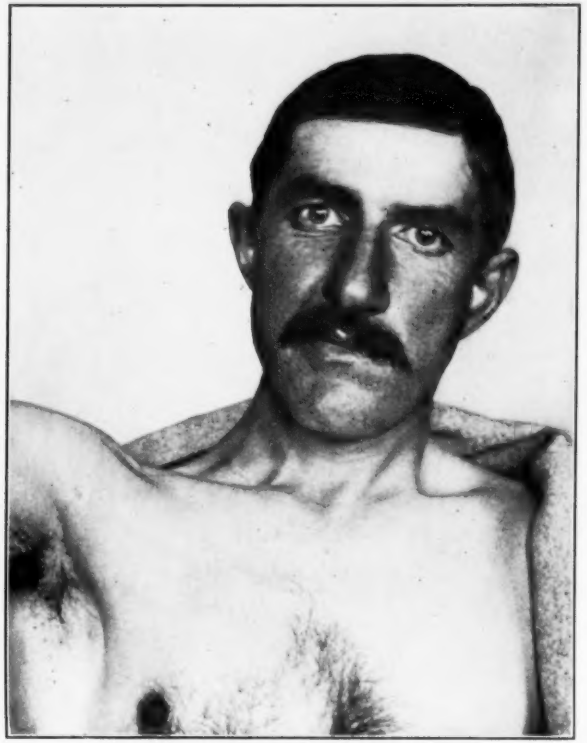
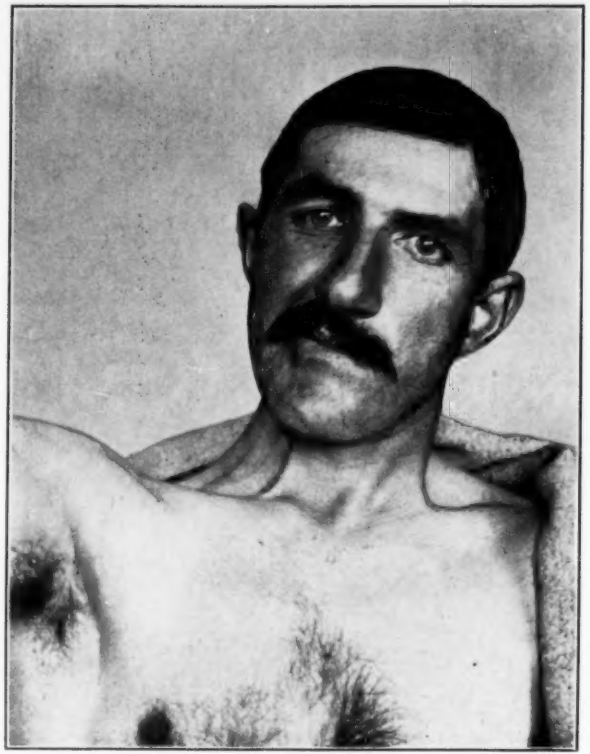


FIG. 8.—October 27, 1902 (168 days). Effort to whistle. (Note that day was dark and exposure long, requiring a very tiring effort.) Coördination perfect, as no other expressional muscles are called into play. Slight prominence of left ala of nose and slight narrowing of left palpebral fissure during this effort.





Photographs taken October 27, 1902 (168th day). Figs. 9, 10, and 11 represent a series with arm elevated at same angle.

FIG. 9.—Arm completely at rest on support. No volitional effort whatever, and yet face is somewhat drawn.

FIG. 10.—Arm completely at rest and with position unchanged; slight volitional effort to contract facial muscles in addition.

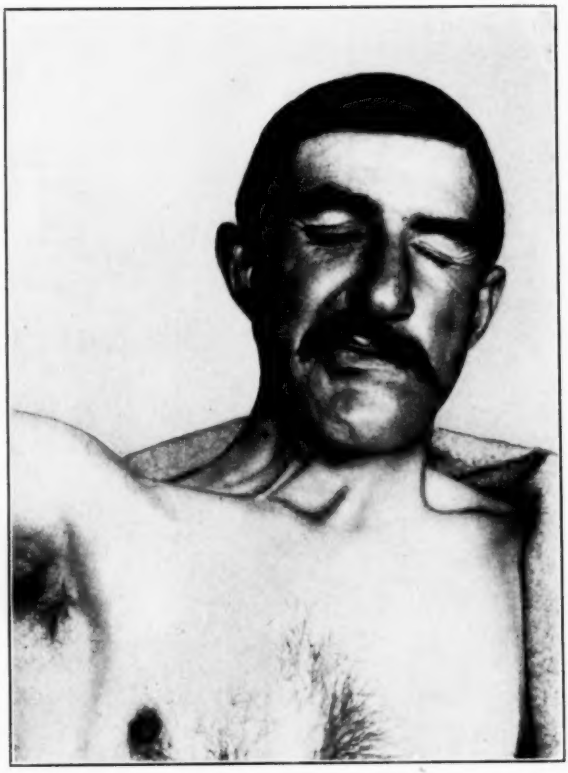


FIG. 11.—(Contrast with Figs. 9 and 10.) Support removed from arm but elevated position maintained. Note shadow of omohyoid on right and paralysis of sternocleidomastoid. Voluntary effort to close eye superimposed on the involuntary facial contraction. Closure of lids not quite complete even under these circumstances.

and the patient make the exertion to keep it in the same position, the exaggerated contraction shown in Fig. 11 is superimposed on the volitional one. Even then the eye cannot be tightly closed. Further examination of the palate shows that the uvula deviates to the left of the median line, that is, towards the normal side. On phonation this asymmetry is still more marked, the palate arches much higher on the left than on the right, and the space between the uvula and the pillars of the fauces narrows on the left and widens on the right.*

The winking reflex is present to a very slight degree. Touching the lash on the right causes an active closure of the left eye, and only very slight movement of the right lid, little more, in fact, than the inhibitory movement of the levator palpebræ heretofore mentioned. The eyeball still rolls upward and outward on volitional closure of the eye.

Taste, much as at last examination, with some retardation of reaction time on the right, though there is perfect recognition of the four taste qualities. The coppery "electrical taste" from faradism of the tongue is much less apparent on the right. Taste over the posterior third of the tongue and on the palate is apparently unimpaired; alike on the two sides.

Electrical Examination.—As at last note with following differences. Indirect galvanic stimulation from the branches of the pes anserinus now gives good reaction in the various muscles. Direct stimulation of muscles with the weakest current which elicits contractions on the normal side contracts the orbicularis. A stronger current necessary for other muscles in which the reaction still remains somewhat lazy. Response to faradic current directly applied to muscles observed for the first time as a fairly strong contraction in the orbicularis palpebrarum, though slight in the other muscles. No response from the nerves obtainable. A slight constant fibrillary action observable in the orbicularis oris and palpebrarum.

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* How much stress may be laid upon this as an argument which favors some seventh nerve supply to the palatal muscles I am unable to say. In case of extirpation of the ganglion of Gasser, I have frequently seen a similar evidence of weakness on the paralyzed side, previous examinations showing a symmetrical palate. Examination of many cases supposedly normal has shown such a deviation to exist without paralysis of either the seventh or fifth nerves.

December 5, 1902 (207 days). Considerable improvement appreciable, though patient has entirely neglected exercises during past month. Coördination of individual movements of expression better, without calling other muscles into play. It is still impossible to move head to left (action of M. sternocleidomastoideus) or to elevate shoulder without calling facial muscles into action. In case of shoulder elevation, however, face can subsequently be almost completely relaxed.

McCarthy's reflex observed for the first time as a slight contraction in lower lid following a tap on the occipitofrontalis. In this muscle itself there is and always has been a sharp contraction with elevation of the eyebrow following a tap on the forehead. This reaction from the degenerated muscle is more marked than on the other side.

Closure of the eye is accomplished with considerably less effort. A unilateral closure on the right, however, is impossible. The bilateral winking reflex brings out a movement of the right lid more marked than heretofore. The eyelids on the side of injury meet in an S-shaped curve instead of a straight line when closed, and at the inner canthus closure is not quite complete unless associated shoulder movement is brought into play.

Electrical reactions show the greatest improvement. As before, the muscles react directly and indirectly to galvanism. Stimulation of the main stem of the facial at the point of anastomosis gives a quick and active contraction of all the facial muscles together. The dislocation of the facial trunk by the operation is shown by the fact that no corresponding point can be found on the normal side, stimulation of which calls forth contractions in both the upper and the lower divisions of the nerve at the same time. A good reaction is now obtainable by direct stimulation of the various branches over the parotid region.

An indirect response to faradism observed for the first time on this date. A powerful contraction of whole side of face at once, obtained from a point about on a level with the angle of the jaw over the cicatrix at the anterior border of the sternomastoid. Corresponding point on opposite side only gives response in trapezius and sternomastoid.

Contraction of individual muscles to direct stimulation with faradic current more marked than at last note, but still feeble.

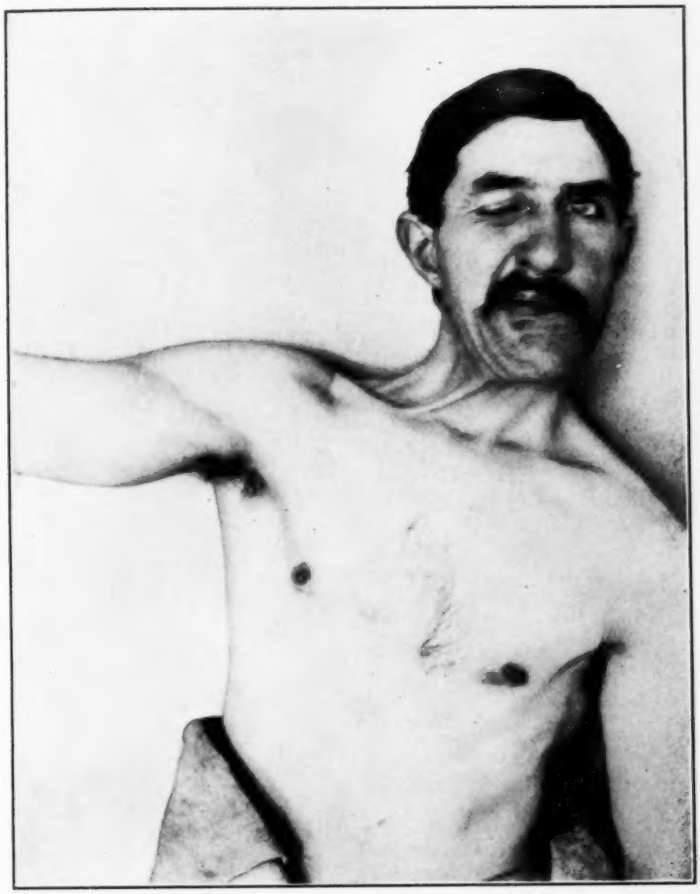

FIG. 12.—(287 days.) Involuntary contraction of the face produced by sudden vigorous elevation of arm and shoulder. Note complete closure of eye, and compare with Figs. 5 and 11.

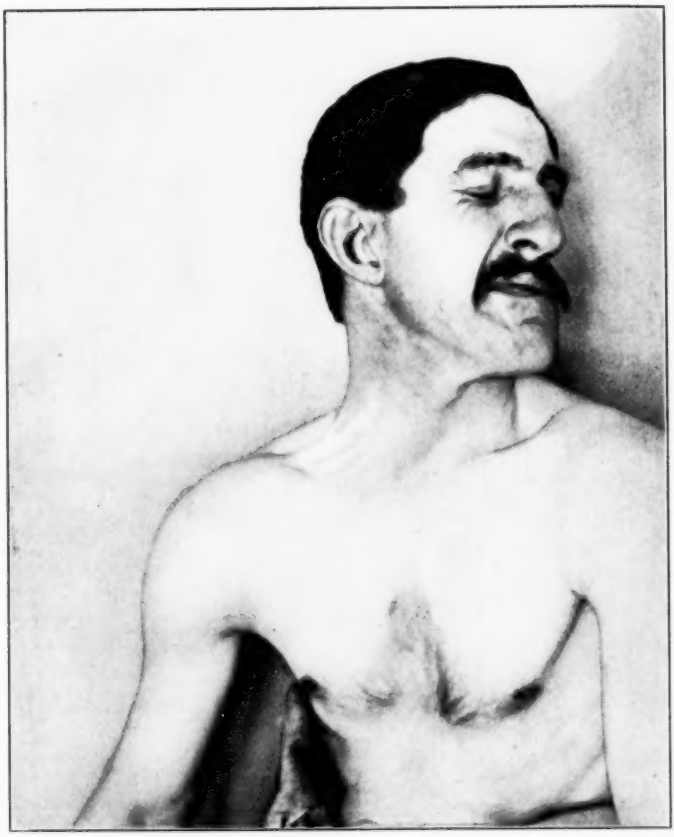

FIG. 13.—(287 days.) Involuntary contraction of the face from sudden and vigorous rotation of the head.

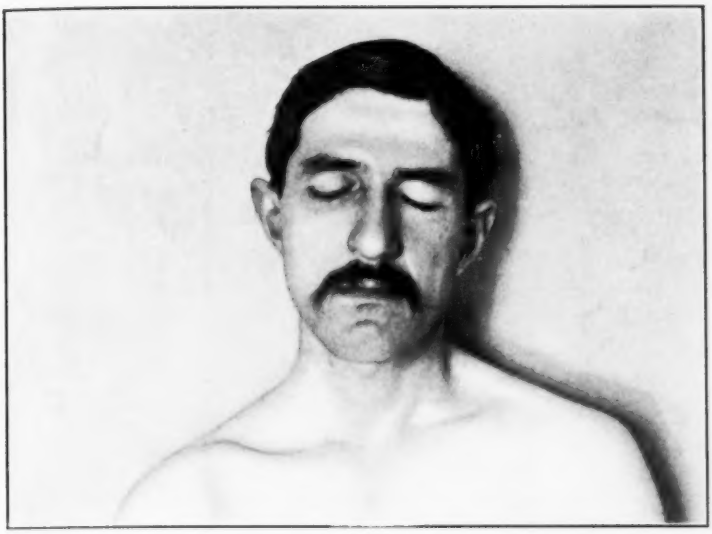

Fig. 14.—1287 days. Symmetrical closure of eyes without associated shoulder movement or contraction of other facial muscles. Perfect symmetry of lips while at rest. Compare Fig. 4.

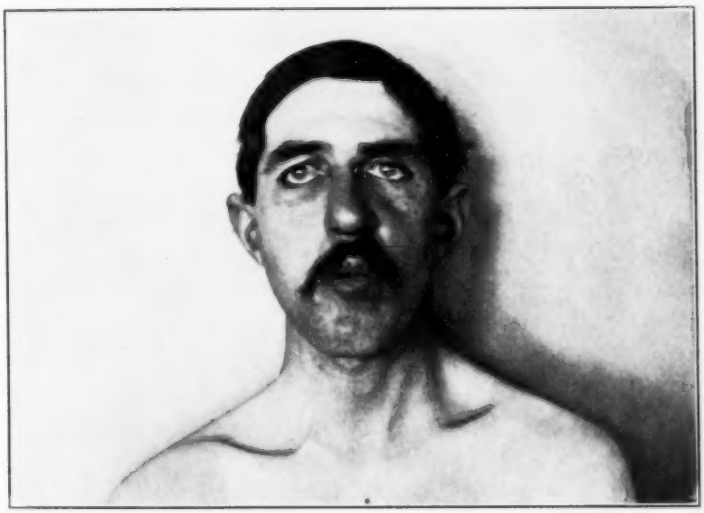

Fig. 15.—1287 days. Fairly symmetrical puckering of lips in effort to whistle, without other associated movements in face or shoulder.

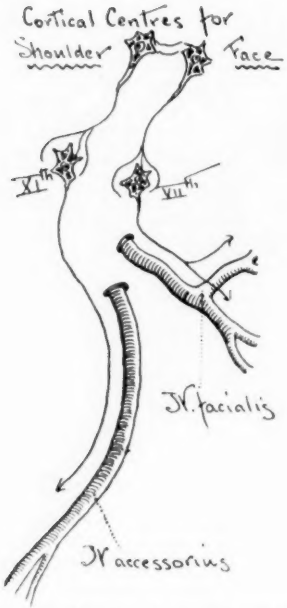

FIG. 16.—Diagram of normal relations of facial and spinal-accessory nerves showing their central connections and paths for efferent impulses.

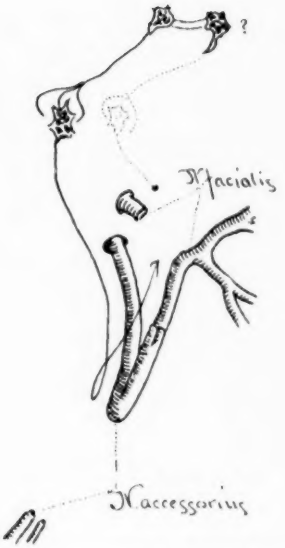

FIG. 17.—Anastomosis by procedure of Létiévant as carried out in writer's case. Passage of efferent impulses to facial muscles shown by arrow. N. accessorius abandoned. Anastomosis made superficial to posterior belly of digastric muscle.

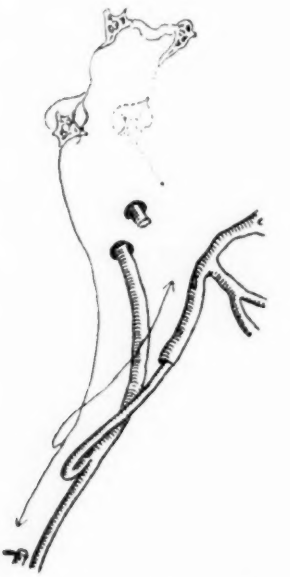

FIG. 18.—Anastomosis as performed by Faure preserving the branch of the N. accessorius to the M. sternocleidomastoideus.

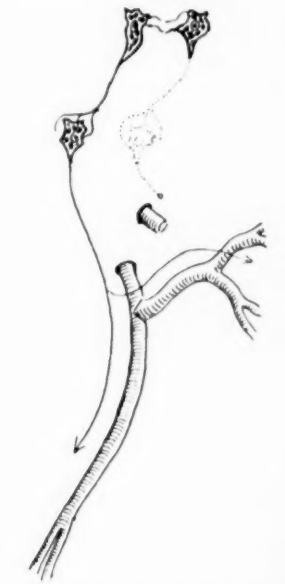

FIG. 19.—Anastomosis as performed by Kennedy by lateral graft, preserving N. accessorius supply to muscles. Anastomosis made behind posterior belly of M. digastricus.

February 23, 1903 (287 days). The electrical reactions on this date are found to be practically normal to faradic and galvanic stimulation, whether applied directly to the muscles or indirectly through the nerves. The same strength of current elicits corresponding contractions on the two sides, the only difference being in the greater ease with which the main trunk of the facial is found on the operative side, owing to its more superficial position.

A violent elevation of the shoulder which would normally call the trapezius into play still contracts the entire facial group of muscles (Fig. 12), and also a vigorous rotation of the head to the left, a movement which would normally be aided by the right sternomastoid, has a similar distorting effect (Fig. 13). Motions of less vigor, however, are possible without producing any accompanying contraction of the muscles of expression.

Individual coördinate movements are under much greater control than at the last examination. The eye can be kept almost completely closed without effort (Fig. 14), and the attempt to whistle shows comparatively little difference in contraction of the two halves of the buccinator (Fig. 15).

Thus, volitional control of individual groups of muscles has returned and can be effected without associated shoulder movements or contraction in the other facial muscles. Emotional expression, however, has not improved in corresponding degree, and as yet it is associated with considerable asymmetry.

The Surgical Procedure.—The simplicity of the problem offered by this particular lesion permits of the adoption of the simplest form of nerve anastomosis as originally proposed by Létiévant. In this form a given nerve with normal central connections is completely divided and its peripheral distribution abandoned as being of comparative unimportance. The central end of this nerve is then brought in its entirety into connection with the peripheral end of the nerve considered of greater importance, but whose central connections have been destroyed (Fig. 17). Other forms of anastomosis also are adaptable to this procedure, the methods employed by both Faure (Fig. 18) and Kennedy (Fig. 19) being somewhat different from my own. Had I been aware of these previous operations, I doubtless would have attempted, likewise, to save a

portion of the nerve supply to the sternomastoid and trapezius. Familiarity, however, with spinal-accessory injury, which almost invariably follows complete "glands of the neck" operations, has bred possibly a too great contempt of the ensuing paralysis, and I had no hesitation in producing the relatively trifling disturbance due to the shoulder droop, in the hope of reclaiming the face. At present, with the knowledge of Faure's failure and of the more pronounced associated shoulder and facial movements, which persisted in Kennedy's case, it seems possible that the complete division of the nerve and abandonment of the M. cucullaris and M. mastoideus may be the better plan. Whether or not normal coördination of expressional movements would in the long run be more likely to follow when there is a complete disassociation of shoulder movements from impulses passing along the same nerve, must remain a problem for time and the study of late results to determine.

Upon matters of technique, it is unnecessary to dwell. The procedure is a delicate one, and the probability of success will depend largely upon the delicacy with which the nerves are handled, upon the accurate approximation of the nerve stumps with the least possible suture material and that placed only in the nerve sheath, upon absolute hæmostasis, and upon the care with which the tissues lining the wound are handled, since it is of the utmost importance that there be a minimum of cicatricial formation. The degree of invisibility and softness of the cicatrix may be taken as an indication of the probability of a successful outcome, since the absorption and organization of blood-clot and of small areas of necrosis with the resultant contraction of new formed tissue is an element which more than any other interferes with the regeneration of an injured or divided nerve.

On purely anatomical grounds, as can readily be understood, this operation is especially suited to those cases in which a lesion of the facial has occurred proximal to the stylomastoid foramen, and, fortunately for the sake of operative repair, it is in this interosseous portion of its course that the nerve is most susceptible to injury whether from disease or traumatism. The

procedure only under exceptional circumstances could be adaptable to cases in which the nerve has been injured peripheral to its point of bifurcation.

The length of time which may elapse after the reception of an injury to a motor nerve and still allow of restoration of function through nerve anastomosis is necessarily uncertain and dependent entirely upon the condition in which the muscles have been kept by massage and electrical exercises. In case there has been complete atrophy of the muscles, so that they no longer respond to galvanic stimulation, probably no hope can be entertained of their recovery. Consequently, should there be any doubt of the completeness and permanency of the lesion, as in the frequent paralyses following otitis media in children, or the severe types of Bell's palsy in the adult, the muscles should be kept in tone by daily galvanism for the number of months during which it may seem advisable to await a possible regeneration without operative intervention.

In cases of undoubted destructive lesions, as in Faure's case and the writer's, the operation, of course, should be done at the earliest possible moment. The failure in the former case was undoubtedly largely due to the long interval, namely, eighteen months, which elapsed between the injury and the operation. An operation such as Bloodgood successfully performed in one instance by exposure and suture in the Fallopian canal of a nerve previously injured in a mastoid operation would, except under most favorable circumstances, be difficult in the extreme, and the procedure would hardly be applicable for the cases in which anastomosis is proposed.

As far as the nerve itself is concerned, a reasonable delay in the operation need alter in no respect the prognostic favorability of the case. Clinical experience as well as the researches of Howell, Bethe, Ballance, and others shows that there is some change, whether a true regeneration or not, which takes place in the peripheral portion of a divided nerve and puts it in a state of readiness most favorable for an early return of function after reunion by suture. It must be remembered, also, that cases of suture of individual nerves have resulted in return

of function, though the operation has been done some years after the original injury.

It is naturally of some interest to consider in what way restoration of cortical control is brought about in transplantations of this kind. That undiminished strength and power of coördination will return to a group of muscles after section and suture of their controlling nerve is a common observation. It is inconceivable, however, that the divided ends of each individual nerve fibre should once more unite in the process of regeneration by perfect coaptation. Supposedly each fibre is represented by a motor cell in the central nervous system so that it is presumable, under the readjustment of healing, that the individual cells make connection with new groups of muscle fibres. Under these circumstances there is on the part of the individual, during the slow period of motor return, an unconscious effort to coördinate the early movements, which by training leads to a perfect result. In case the nerve is grafted into an entirely different motor territory, the problem of functional restoration becomes much more complex, and the training of coördination would supposedly be correspondingly difficult. Return of well coördinated movement nevertheless seems experimentally to have been as rapid in cases of nerve anastomosis as in those of simple nerve division. Probably the age of the individual is a most important factor, and without doubt the younger the subject the more favorable is the prognosis after nerve anastomosis, especially in case muscles with such an elaborate coördinate action as those of facial expression are concerned. It is natural that especial difficulties would be encountered under such circumstances, owing to the complex emotional nature of facial movement.

It is interesting to speculate as to whether volitional impulses, in case of a successful spinofacial anastomosis, are transmitted by way of the original facial centres in the motor cortex, passing thence to the centres presiding over shoulder movements by way of commissural tracts, or, on the other hand, whether impulses pass directly to the muscles of expression

through the cortical centres once controlling movements which bring the sternocleidomastoid and trapezius into play. In the latter case the original facial centres would be entirely thrown out of the new mechanism of transmission. Doubtless faradization of that part of the ascending frontal gyrus, wherein lie the motor cells of the higher system of neurones connecting the cortex with the N. accessorius centres in the upper part of the spinal cord, would elicit movements of the facial muscles. It is inconceivable, however, that such a complex performance as the calling out of expressional movements should come, especially in an adult, so readily under the control of cortical cells originally presiding over such relatively simple actions as those which the trapezius and sternomastoid represent. The very extent of motor cortex which corresponds with facial movements in comparison with the circumscribed shoulder area would argue against the possibility that the latter could assume the function of the former, and it is difficult to believe that the original facial centres do not continue to exercise motor facial control, although the impulses must travel thence by commissural fibres to the cortical centre for shoulder movements, and so to the upper part of the cord, the N. accessorius, and ultimately to the facial *via* the point of grafting.

It is true that Kennedy has apparently proven in his experimental cases of crossed anastomosis on dogs, in which an interchange of function was established between the flexor and extensor nerves of an extremity with ultimate restoration of coördinate motion, that subsequent cortical stimulation of the flexor centre provoked extensor movements and of the extensor centres flexor movements. It is conceivable, however, that, although the major effect of stimulation of one centre, the flexor, for example, was to call forth extensor movements, the flexor centre may still have had some less apparent control over flexor activities through connecting fibres with the extensor centre. In his experimental conditions this could hardly have been demonstrated by electrical excitation of the cortex.

In my patient, for example, when an incoördinate contraction of all of the facial muscles on the side of anastomosis

was occasioned by a forcible elevation of the shoulder or arm or by rotation of the head, volitional and more or less properly coördinated movements of expression could be superimposed on this involuntary underlying reaction, as though the facial centres had some regulatory control of expressional movements over and above the incoördinate action newly assumed by the centres which originally governed motion in the spinal accessory pair of muscles.

The dog's cortex is hardly a favorable one for such observations, owing to the circumscribed extent of the motor territory; and I am unaware that any studies on the higher apes have been made with the object of determining the motor responses to cortical stimulation after nerve transplantations.

The course of these impulses after an anastomosis such as has been described can consequently only be conjectured, and it seems that there are two possible hypotheses:

1. That the cortical centres concerned in shoulder movements (trapezius) and rotation of the head (sternocleidomastoid) may themselves in the course of time be educated by training to coördinate the impulses, which have been sidetracked into the motor area of the facial nerve, so as ultimately to lead to expressional movement.

2. That the cortical centres originally presiding over movements of the face continue to play a part in the coördinate action of these muscles, possibly influencing the higher neurones of the N. accessorius through the intermediation of connecting tracts in the cortex.

HISTORICAL AND BIBLIOGRAPHICAL NOTES.

I. The first operation, that by FAURE, was performed January 28, 1898, on a patient eighteen months after an injury causing paralysis of the facial nerve. The first communication on the subject was presented by Faure before the Académie de Médecine, Séance du 1er Mars, 1898.

II. The procedure was made public six weeks after the operation under the combined names of FAURE and FORET in the *Gazette des Hôpitaux*, 71e année, 8 Mars, 1898, p. 259, under the title "Traitement chirurgical de la paralysie faciale consécutive à un traumatisme intra-rocheux." L'anastomose du facial et de la branche trapézienne du spinal. Ref. in the *Centralblatt für Chirurgie*, 1898, No. 47. This paper is largely an argument for the feasibility of the operation.

III. FORET, individually (fifteen weeks after the operation), read a paper based on the same case before the Otological and Laryngological Society of Paris. Compte rendu officiel de la Société française d'Otologie et de Laryngologie, Séance du 5 Mai, 1898.

IV. A later mention of the case appears in FAURE's communication nine months after the operation before the Congrès française de Chirurgie, XIIe Session, Paris, Octobre, 1898. (See *Révue de Chirurgie,* T. 18, p. 1098, 1898. "Traitement chirurgical de la paralysie faciale par anastomose spinofaciale.") The case was then reported to be stationary, and its failure attributed to the long duration of the lesion before operation. Faure gives the credit of the suggestion to his colleague Foret.

V. BARRAGO-CIARELLA seemingly demonstrated on experimental grounds that, in case of immediate anastomosis after division of the facial, return of function would follow in a few months, whether spinal accessory or vagus was utilized for the central attachment. Three experiments not conclusively worked out. His results were published in *Il Policlinico* (Sezione Chirurgica, Vol. viii–C. (fasc. 3), Febbraio, 1901, p. 124), under the title "La sutura dell' accessorio di Villis col facciale, nella paralisi del facciale." Extensively reviewed by Bréavoine (see Ref. 8) and in the *Centralblatt für Chirurgie,* 1901, Band xxviii, p. 718.

VI. MANASSE, independently, but soon after Faure's publication in 1898, performed five experiments on dogs. His results were published in 1900 in the *Archiv für klinische Chirurgie,* Band lxii, S. 805, 1900. Ueber vereinigung des N. facialis mit dem N. accessorius durch die Nervenpropfung (Greffe nerveuse). Three of these experiments were perfectly conclusive, subsequent histological examination showing continuity of regenerated nerve fibrils across the point of suture.

VII. As an introduction to the excellent thesis of his pupil Bréavoine, M. FAURE made a final report of his case before the Congrès de Chirurgie, Paris, 21–26 Octobre, 1901. It was then three years and nine months after the operation. He regarded the case as a "demi-succès," not appreciable at their earlier communications, since the muscles had recovered in a measure their excitability to faradism, although there was no voluntary motion whatever.

VIII. The most important contribution on the subject of nerve anastomosis, and the only report hitherto of a successful case of the Faure-Foret procedure followed, appearing in the Philosophical Transactions of the Royal Society, Series B, Vol. cxciv, pages 127–162. The facial nerve in this case was divided for unilateral spasmodic tic, an immediate anastomosis being made with the spinal accessory. The operation was performed May 4, 1899, by ROBERT KENNEDY.

IX. The thesis by BREAVOINE, a disciple of M. Faure, presented for his doctorate July 10, 1901, has ably summed up the history of spinal accessory facial anastomosis since the time of Foret's original suggestion. "Traitement chirurgical de la paralysie faciale d'origine traumatique par l'anastomose spinofaciale," Paris, 1901.

ON THE POSSIBILITY OF OPERATIVE RELIEF OF CERTAIN FORMS OF FACIAL PARALYSIS.[1]

WITH REPORT OF A CASE.

BY LEVI JAY HAMMOND, M.D.,

OF PHILADELPHIA.

THE fact that the greater part of the intracranial segment of the facial nerve is lodged in a bony canal makes it probable that facial palsy will be the result of injury or disease to the nerve more often in this part of its course than either centrally or peripherally; hence its frequent occurrence from fractures of the middle fossa of the skull, from neuritis following infectious diseases, from trauma other than fractures which may cause rupture of the minute blood-vessels and extravasation of absorbable blood-clot, either in the sheath of the nerve or into the bony canal, also from carious bone or inflammatory exudate about the nerve, from disease of the nerve itself, or from passive hyperæmia.

A case is recorded by Hewett (*International Encyclopædia of Surgery*, Vol. v, page 106), in which a blood-clot occurred in the common sheath between the facial and the auditory nerves following a blow on the side of the head. A similar paralysis may follow any condition that would cause hyperæmia of the numerous small blood-vessels within the aqueduct of Fallopius.

The most reliable symptoms that characterize interference with the function of the nerve within the Fallopian canal, as deep within the bone as the geniculate ganglion (this being more often the location of the disease or injury to this nerve), are complete unilateral paralysis of all muscular movements, absence of hæmiplegia, decidedly abnormal electrical reactions,

[1] Read before the Philadelphia County Medical Society, February 25, 1903.

loss of reflex associated movements, existence of paralysis in the upper and lower halves of the face, and in addition to loss of function over the area of distribution of the nerve, paralysis of the fauces, the palate, and the uvula, may also occur as a result of the decussation of the great superficial petrosal nerve which is given off at this point to join the sphenopalatine ganglion.

When paralysis is due to injury or disease involving the geniculate ganglion itself, there is, in addition, dryness of the mouth on the same side, with some loss of taste in the anterior half of the tongue, also increased sensitiveness to musical sounds; all facial movements are paralyzed.

When, however, paralysis is due to central lesion, anywhere between the nucleus in the pons and the bottom of the internal auditory meatus, paralysis is not complete, because the branches supplying the eyelids are not affected, thus permitting of winking of the lids. This fact is said by physiologists to prove the existence of crossed fibres at the point of origin of the facial nerve, and is a valuable point in differentiating central lesions from those within the bony canal. It is associated also with hemiplegia, and usually with normal electrical reactions; there is also persistence of the associated reflex movements. There is generally degeneration from paralysis of the muscles in the upper half of the face, especially the occipitofrontalis, corrugator supercillii, orbicularis palpebrarum, and dilator narium. Not infrequently the sixth or abducens nerve is involved, causing internal strabismus; the eighth also may be implicated, causing some degree of deafness.

When the lesion is situated outside of the cranium, the paralysis affects the muscles only, and is less complete than when the lesion is centrally located. In fact, paralysis is confined entirely to the area of distribution of the particular nerve fibres involved. Under all conditions, when the nerve is paralyzed, there are certain constant and well-known symptoms present, such as absence of normal wrinkles, inability to close the eyes, irregularity in the nostrils, flaccidity of the buccinator muscle, collection of food in the mouth, and dribbling of saliva.

A case with symptoms pointing towards involvement of the nerve within the aqueduct of Fallopius presented itself at the clinic of Professor Randall at the University of Pennsylvania in July, 1902, and during his absence came under my care with the following history:

B. S., about thirty-six years of age, married, four children. Thirteen years before had had an attack of pain in the right mastoid bone. There were marked tenderness and some swelling, which continued for several weeks, disappearing spontaneously without suppuration appearing either in the auditory canal or in the mastoid bone; there were intense headache, sleeplessness, and especially gnawing and boring pain at night, the last-named being especially disturbing. All the symptoms, including the pain and tenderness over mastoid, slowly disappeared.

There was no further trouble complained of from the time of the disappearance of these symptoms (in seven or eight weeks) until two years afterwards, when she had a second attack of pain and tenderness over the mastoid, with again marked meningeal symptoms. There was not at this time any swelling nor discharge of pus from either the auditory canal or the mastoid. On this occasion, pain, tenderness, and cerebral symptoms persisted for four months, and then gradually subsided, excepting the tenderness, which persisted until February 15, 1902. On the latter date a third attack occurred, characterized by severe pain with some swelling and increased tenderness over the mastoid, pain radiating over the brow, cheek, and lower jaw, associated with vertigo, intense headache, and marked meningeal symptoms. With the beginning of this attack facial palsy developed for the first time. Again the symptoms, including the palsy, began to subside after acute suffering for about ten days, the palsy nearly disappearing. This last attack was suddenly ushered in from taking cold, July, 1902, or five months after the third attack. On this occasion, the palsy, pain, tenderness, and meningeal symptoms were again pronounced. Examination of the ear on July 28, 1902, showed nothing abnormal except, possibly, slight injection of the membrana flaccida posteriorly. Percussion over the mastoid caused intense pain, especially over its upper portion; surface temperature seemed decidedly increased. There was no swelling over the mastoid, nor any discharge from the middle ear. Facial palsy was

marked, and included the entire area of distribution of the facial nerve; there were excessive postnasal granulations from which a viscid secretion constantly exuded. In the absence, therefore, of visible middle-ear disease, and with the characteristic gnawing and boring pain of bone disease, with marked tenderness on percussion over the upper mastoid region, and with the history of repeated attacks similar in character confined to the same region, I was led to regard this case as one of chronic pyogenic osteitis of the petrous portion of the temporal bone, which was responsible for the complete palsy which existed. Exploratory operation was therefore advised, August 1, 1902.

The usual postauricular incision for exposing the mastoid bone was made, the outer table of bone was removed with a gouge, and the antrum and attic exposed. A large, disorganized blood-clot was found within the antrum, filling it completely, resembling finely ground coffee. The antrum walls were entirely carious, caries extending well in and involving a part of the outer table of the petrous portion of the temporal bone; this was curetted away. The mastoid wall and the mastoid cells proper were apparently healthy. It was decided, however, to completely exenterate the entire mastoid, and, in the absence of precise knowledge as to the cause of the pain, it was decided to expose the lateral sinus for inspection, which was done and found to be free from thrombus.

In removing that portion of the carious bone through which the facial nerve passed, care was taken, of course, to avoid injury to the nerve. It was felt at the time of operation that all carious and necrotic tissue had been removed, and that aseptic toilet could be complete; the cavity was therefore filled with moist blood-clot and the incision closed with catgut, without drainage. Union was by primary intention. Paralysis entirely disappeared within twelve hours after operation, and the patient left the hospital on the fifteenth day.

This case seems to illustrate very clearly the existence of a chronic pyogenic osteitis that had been going on for years, and, in all probability, the blood-clot found was one of many that had previously formed and been absorbed. Such a process would account for the acute attacks of pain and palsy from which the patient had previously suffered during these years.

In other words, paralysis in this instance was due to a slow inflammatory compression from exudate about the nerve, rather than to disease of the nerve itself. This it seems to me would explain the clearing up of the paralysis in the previous attacks. The pathological findings would lead one to believe that without operation it could not have cleared up again, as the compression of the nerve from the carious bony wall could not have been in any other way removed.

It is obviously important, in cases of this character, to remove the cause of compression, which is generally a slow compression rather than an acute one, before permanent nutritive changes take place. Of course, if the operation is delayed until hyperplasia of the connective tissue and interstitial neuritis take place, perfect recovery cannot occur, even though the cause be removed.

I have recently learned that this patient complains of some pain, which is probably due to an interstitial neuritis; there was not, however, any recurrence of the paralysis more than four months after the operation.

INTRACRANIAL NEURECTOMY.

REPORT OF A CASE FOLLOWED BY EXTENSIVE TEMPORARY PARALYSIS.

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OF NEW YORK CITY,

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THE increasing tendency, on the part of both patient and surgeon, to seek surgical interference in cases of trifacial neuralgia is a sure indication of the improved technique and decreasing mortality from the operation. In no class of cases is one more anxious and ready to employ elective surgery, when once one has either seen or, worse still, experienced the frightful suffering of a paroxysm of tic douloureux.

In the interesting series of cases operated upon by various surgeons, collected and reported by Dr. Louis Tiffany (ANNALS OF SURGERY, Vol. xxiv, page 575), several examples of permanent or temporary injuries produced by the operative manipulation are recorded.

The present report is for the purpose of putting on record another case of this character.

J. M., male, aged fifty-four years, a native of Vermont, presented himself to the writer, June 1, 1902, suffering from tic douloureux. Eight years previously he began to have paroxysmal attacks of pain, involving the second division of right trigeminal nerve. At first the pain was not very severe and the paroxysms were not frequent, with intervals of several weeks of complete immunity. During these eight years the disease progressed with varying speed in spite of all medical treatment.

At the time he presented himself he stated that he had been suffering almost constantly for two weeks with intense paroxysm of pain lasting about twenty seconds, with four-minute intervals. Occasionally during the two weeks the pain ceased for a few hours at a time.

During this attack the pain was most severe in the second

division of the fifth nerve, with less marked twinges in the third division. His family and personal history are otherwise negative.

Examination shows a large, robust, well-nourished man of good intellect. The skull was markedly scaphocephalic; avulsion of the right Gasserian ganglion was determined upon, and the patient prepared for operation.

Operation, June 2, 1902. Ether narcosis. The skull opened by a horseshoe-shaped osteoplastic flap, the base extending to the zygoma. The middle meningeal artery emerged from a bony canal just below the line of fracture of the flap and was there ligated and severed. The dura mater was carefully stripped from the bone with the finger. The middle fossa was found to be very deep, and, in order to expose the exits of the second and third divisions of the fifth nerve, the brain had to be crowded more towards the median line than is usual. The foramina ovale and rotundum were finally clearly exposed and the nerves emerging through them identified. Both nerves were divided. An attempt was then made to follow proximally the stump of the third division up to the ganglion, but the hæmorrhage becoming very troublesome, the operator contented himself with grasping firmly with forceps the stump of the third and second divisions and tearing away as much of the ganglion tissue as could be accomplished in one effort. A piece of sterile, flat, gutta-percha tissue was laid over the foramina ovale and rotundum and the brain allowed to fall into place. The bone flap was replaced and sutured completely, save for a narrow gutta-percha drain extending to the bottom of the skull.

The recovery from anæsthesia was uneventful.

For the first two or three days after operation patient was very drowsy and lethargic, but answered questions rationally when sufficiently aroused.

At the first dressing (on second day) there was noted a complete paralysis of right upper eyelid, also of all the muscles of the eye supplied by third, fourth, and sixth cranial nerves. Pupil markedly contracted. Vision, however, appeared normal. There was partial paralysis of left upper extremity, most marked about the fingers.

During the subsequent week the wound healed perfectly, the drain having been removed on the second day. The paralysis persisted and the mental condition only slightly improved. On

the tenth day the patient was allowed out of bed, and it was then noted that motion of left leg was also slightly impaired. At the end of two weeks the drowsiness and lethargy had sufficiently improved to admit of the patient's return to his home in the central part of the State. Otherwise, his condition was unchanged.

In October, four months after the operation, Mr. M. again visited the writer, having reported frequently by letter in the interval.

He stated that five weeks after the operation he began to be able to lift the right eyelid a little. The improvement continued until all the paralysis disappeared; this, he thinks, was about ten weeks after the operation.

At the time of his visit in October, he stated that he was perfectly well and free from all pain, but did not feel as strong as before the operation; also that his memory was very defective, a condition not existing before the operation.

On examination, no evidence of paralysis could be found, save a contracted pupil on the right side. Anæsthesia over course of second and third divisions of right trifacial nerve. He was told to continue the tonic treatment advised and to report again. In January a letter from him states that he is as well as ever, but not quite up to his full strength.

Pressure by the retractor in making a suitable exposure of the very deep middle fossa was undoubtedly the cause of the paralysis. In this case, in order to do the operation safely, the trauma could not be avoided.

The method advocated by Abbe (ANNALS OF SURGERY, Vol. xxxvii, page 7) for exposing the foramina doubtless precludes the risk of much pressure on the brain, but the point of entrance would be a difficult one in the case of a scaphocephalic skull with its dependent middle fossa. In such a case the writer would prefer the Hartley incision as offering a straighter though longer route to the objective field.

While the resulting paralyses were much to be regretted, and to be avoided, if possible, nevertheless, if the operator is perfectly confident that he had not divided any structures save those intended, the case reported shows that he should have every confidence in an ultimate recovery.

THE SURGERY OF THE LOWER URETER.[1]

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ANATOMY OF THE PELVIC URETER.

THE pelvic portion of the ureter is naturally divided into two portions,—the parietal or fixed and the visceral or mobile. The parietal portion begins just after the ureter has crossed the iliac vessels, from which point it winds over the brim of the pelvis and passes downward and outward in close contact with the lateral wall, to a point about three centimetres in front of the spine of the ischium. At this point it makes a sharp bend inward and begins the second part of its course (the visceral) across the floor of the pelvis, on the upper surface of the levator ani muscle, to reach the base of the bladder. In the first part of its course in the left side the ureter lies in front and to the side of the internal iliac artery; on the right side it lies directly in front of it, and almost exactly parallel with it. On the left side the rectum lies in relation to the ureter in the first part of the pelvic course; but as the ureter passes outward it is separated from it by the parietal peritoneum which covers it, and it is only in relation to the rectum when it is overdistended. On the right side the ureter is never in relation with the rectum, being considerably distant from it. The ureter is crossed by the two branches of the hypogastric, the obturator and the umbilical, both of which pass in front of it.

In the second part of its course it is separated from the rectum by the levator ani muscles, and lower down, just before its entrance into the bladder, by the top of the seminal vesicle. The ureter is here crossed at right angles in front by the vas deferens, which winds around it from the lateral wall of the

[1] Read at the meeting of the Southern Surgical and Gynæcological Association, Cincinnati, November 12, 1902.

bladder, on its way to the upper end of the prostate. The peritoneum covers the ureter down to a point about two centimetres from the junction of the bladder, when it is reflected upward to cover the posterior surface of this viscus. For this space of two centimetres the ureter is loosely held to the bladder by connective tissue, and one may cut through the bladder into the ureter without getting into the peritoneal cavity.

To the outer side of the ureter the peritoneum dips downward around the upper end of the seminal vesicle, the upper end of which is thus separated from the rectum by two layers of the peritoneum (as the seminal vesicles lie beneath the ends of the ureter, the danger of opening the peritoneal cavity when attempting to reach the ureter from the peritoneum is manifest).

The course of the ureters through the bladder-wall is obliquely downward, inward, and forward for a distance of about eighteen millimetres, when they terminate in oval or slit-like orifices, enclosed on each side by folds of vesical mucous membrane which act as valves.

According to Delbet,[1] the trigone should be considered as constituted by an expansion of the muscular fibres of the ureters. Having arrived at the level of the bladder, the longitudinal fibres pass through the vesical wall, some incorporating themselves with the internal or plexiform layer of bladder muscle. The others, much more numerous, pass through and spread out like a fan in front of the vesical wall proper to form the trigone as shown in Fig. 1.

The posterior fibres proceed transversely inward and become continuous with the fibres from the ureter opposite, thus forming the interureteral muscle (Mercier's bar). The fibres which constitute this muscle are fine and compact; they pass in front of the fibres proper of the bladder, from which they are separated by a layer of fibrous tissue. The anterior fibres pass obliquely forward and inward, and, describing concentric curves, assist in forming the sphincter of the bladder. Some superficial fibres run in a direction nearly anteroposterior, and gliding under the mucosa of the vesical neck are continuous

with the internal longitudinal layer of the urethra. The trigone as thus formed is a very strong fixed body, and the ureteral orifices are firmly held together and maintained in their oblique course. Even with considerable over-distention of the bladder the interureteral distance is little disturbed. According to Glantenay,[3] the ureter preserves its own muscular coats, which are separated by a layer of connective tissue from the surrounding bladder muscle.

The caliber of the intramural ureter here is much narrower than above the bladder, but not as narrow as at its orifice. No definite ureteral sphincter has ever been demonstrated, but the trigonal muscle fibres which surround it evidently serve such purpose, as it is impossible to cause a reflux of the fluid from the bladder into the ureter, by even the greatest intravesical distention, as was demonstrated by the writer in 1898.[4] (See therein a discussion of the ureteral reflux and reversed peristalsis.)

The mechanism of intermittent evacuation of urine from the ureters varies in different subjects. As seen through the cystoscope, it is generally as follows: The orifice is first opened and drawn back and outward. The urine then begins to flow in a swift stream. The muscle of the trigone then contracts, and the orifice is then drawn forcibly downward and closed as the last urine escapes. At times the muscle action is very slight, and the outflow of the urine, being less vigorous, is more difficult to detect.

In the female the first or parietal portion of the pelvic ureter is similar in its course and relations to that portion in the male. The second part runs forward and inward beneath the broad ligament at a distance of about two centimetres from the side of the uterus. Lower down rapidly approaches the lateral wall of the vagina, and passes obliquely in front; it lies in the last one centimetre of its course (above the bladder), in direct contact with the anterior wall of the vagina. During its intramural course the posterior wall of the bladder is closely adherent to the anterior vaginal wall. The uterine artery and veins accompany the ureter in its course, being closely adherent

FIG. 1.—Showing the relation of the musculature of the trigone to that of the ureter and bladder.

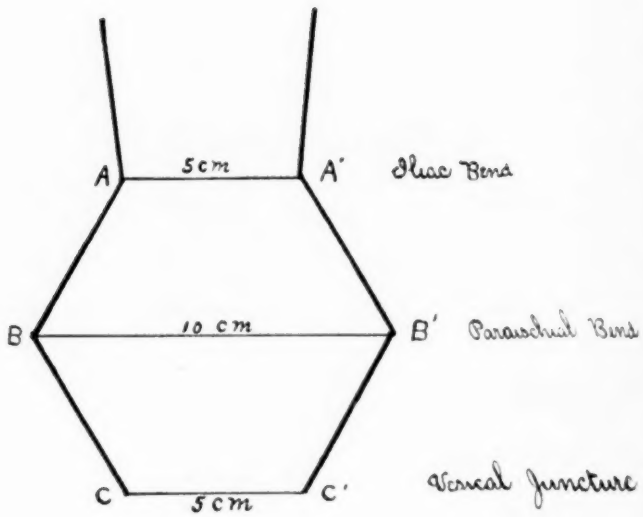

FIG. 2.—The ureteral hexagon.

to it, but, as the ureter passes out of the anterior surface of the broad ligament, the vessels turn inward in front of it.

The writer has previously proposed[21] that the different portions of the pelvic ureter be designated according to its relations, as follows:

The iliac portion, where it crosses the iliac vessels.
The parasacral, where it lies in front of the sacrum.
The paraischial, where it is adjacent to the ischium.
The juxtavesical, that segment just above the bladder.
The intramural, within the musculosa of the bladder.
The intravesical, just above its orifice and covered by vesical mucosa.

The measurements of the pelvic portion of the ureter vary considerably in different subjects, being largely dependent upon the size and shape of the pelvis and the condition of the muscular lining and floor.

It is an interesting fact, which I called attention to in another paper,[22] that the pelvic course of the two ureters may be represented with fair accuracy by a hexagon, the sides of which are each about five centimetres in length, as shown in the accompanying diagram.

Measurements of the distance between the two ureters show that they are about five centimetres apart at the brim of the pelvis (from five to seven) when they cross the iliac arteries, and also about five centimetres apart when they enter the posterior wall of the bladder. At the paraischial bend they are about ten centimetres apart (ten to twelve), or double the distance above and below. Measurements also reveal that the distance from the bend at the pelvic brim to the paraischial bend is about five centimetres, and that the distance from this point to the entrance into the posterior wall of the bladder is also five centimetres. The course of the ureters within the pelvis, therefore, form quite a perfect hexagon, each limb (radius) of which is five centimetres, as shown in the diagram; thus, A and A′ represent the bend of the pelvic brim, and are, of course, five centimetres apart. B and B′ represent the paraischial bends, and are ten centimetres apart (double radius). C and C′, the points of the junction with the bladder, are also five centimetres distant. A B and A′ B′, B C and B′ C′ are like-

wise five centimetres. We see that such a hexagon corresponds quite accurately with the average anatomic distance of the ureters, and gives at once an easy and fairly accurate idea of their intrapelvic course. In the female, a hexagon with the sides six centimetres long is more accurate than five centimetres, the distance being this much greater than in the male.

Turning to the conditions of the ureter requiring surgical interference, we find in the literature the following:

Anomalies. Prolapse. Ureteritis. Calculus. Fistula. Tumors. Valve formation, and stricture.

URETERAL ANOMALIES.

1. As to number: The most common is that of double ureter on both sides. The ducts generally enter the bladder side by side, and both orifices may be seen with the cystoscope. Sometimes the two ureters join at some point between the bladder and the kidney, and present only one orifice in the bladder.

Cases of double ureter on each side have been recorded, and Morris asserts that the second ureter has proved valuable, its mate being blocked by calculus. Brewer had a similar case, one ureter and half-kidney being tuberculous, the other healthy. The writer had a case in which the left ureter was catheterized and clear urine obtained, but it was found at autopsy that the catheter had entered the lower branch of a bifid ureter, which led to a healthy lower half-kidney. The upper half was filled by a very large calculus which blocked its ureter completely.

2. As to location of the termination: The following classification is given by Delbet.[1] (*a*) In the bladder. The course of the ureter through the bladder-wall may be much too long or the lumen may be congenitally strictured. Schartz reported a case in which the lower end of the ureter was closed, and the dilated portion above was separated from the bladder by a double layer of mucous membrane. (*b*) In the rectum. Termination in the rectum has occurred, but always in monstrosities. (*c*) In the prostate. In the male the ureter has been found to open in the veru montanum, and in other parts of the

prostatic urethra. It has also been found to open into the ejaculatory ducts, the seminal vesicles, and the vas deferentia. (*d*) In the female; into the vagina, the uterus, the prepuce of the clitoris, and the urethra.

According to Morris,[2] these anomalies are directly dependent on errors of development, and are usually associated with other congenital deformities. Those in the lower part of the vagina or rectum are seldom found except in monsters. As the abnormal orifice is always narrowed, dilatation of the ureter above is generally present. When the termination in the bladder is blind, there is generally a thin-walled intravesical tumor in the region of the ureter (prolapse).

Fenger,[5] in a very thorough discussion of the subject, outlines the treatment as follows: The abnormal termination of open ureters in the urogenital apparatus in man will probably never be diagnosed, and consequently will not be an object for treatment. On the other hand, the abnormal termination of the ureter in the vulva, vagina, or urethra in woman has already often demanded surgical interference, with the object of curing the incontinence. The operation has for its object the direction of the abnormal ureter into the bladder as near as possible to the normal place, and the exclusion of the distal end of the ureter from the passage of urine.

The following methods have been proposed:

(1) Epicystotomy: implantation of the ureter in the posterior wall of the bladder and obliteration of the peripheral end.

(2) Excision of the distal end of the abnormal ureter; vaginal implantation of the proximal end into the bladder.

(3) Extraperitoneal isolation of the abnormal ureter and the bladder through a convex subpubic incision, and resection of the lower border of the symphysis. Through this wound the ureter is isolated and its central end implanted into the bladder. Colzi reports one successful case.

(4) Ureterocystotomy: a communication made between the bladder and the dilated portion of the abnormal ureter. Wölfler effected this with apparent success by means of a special instrument analogous to Dupuytren's enterotome.

"Criticism of the Methods. Epicystotomy and implantation of the ureter in the posterior wall of the bladder, although successfully performed by Tuffier and Baumm, is a more grave operation than the vaginal implantation. The same may be said of the extraperitoneal implantation with partial resection of the symphysis, as successfully performed by Colzi. To make a direct communication opening between the dilated ureter and the bladder, as done by Wölfler and Bois, is technically difficult. Thus the operation from the vagina is probably the safest method, and should be first attempted. If not successful, one of the other methods might be resorted to."

PROLAPSE OF THE URETER INTO THE BLADDER.

This is a rare anomaly, judging from the fact that only about seventeen cases have been recorded. The prolapse may be congenital or acquired. Of the fourteen cases collected by Blumer [6] ten were evidently of congenital origin, and in five cases led to death early in life. The deformity in these congenital cases consists for the most part in a partial or complete closure of the lower ureteral orifice. The terminal prolapsed portion of the ureter may alone be dilated, the ureter above being normal. On the other hand, there may be a uniform dilatation of the entire ureter.

Of still another variety is a case previously reported by the writer [7] in which there was present ballooning of the ureter while it was functionating, but which would disappear as soon as the outflow of the urine ceased (see full history, Case I in appendix).

The etiology of all these cases is probably to be ascribed to the stricture at the orifice of the ureter. Dickinson ascribes the subsequent prolapse to the downward pressure exerted by the swollen and rigid cylinders (ureters). But dilated ureters are common at the autopsy table, being present in numerous cases of prostatic hypertrophy, but we never see a case of prolapse among them.

Burckhart held that the abnormality arose from the congenital lack of musculature of the bladder-wall. Boström held

that it was due to the ureter passing not obliquely but straight through the bladder-wall.

I think my case showed that neither was correct, but that the dilatation occurs first in the intravesical portion of the ureter, above the stricture, at the extreme orifice of the ureter (first a collapsing balloon). Later the dilatation proceeds upward, destroys the sphincteric character of the surrounding muscle, and the balloon becomes permanently filled, the so-called prolapse, with ultimately dilatation of the entire ureter and renal pelvis above.

The following interesting case was reported by Caillé.[8] A female child two weeks old presented a rounded tumor, the size of a walnut, protruding from the urethra. After careful examination, it was found that the tumor was a prolapse of the right ureter, which was greatly dilated externally, but connected with the interior of the bladder by a narrow pedicle. This was ligated and divided. The child died and autopsy showed marked dilatation of both ureters.

URETERITIS.

This may be simple or tuberculous, and is not different in the lower ureter than in the upper, except that it is much more apt to lead to stenosis at the lower end. It is principally on account of its diagnostic value that I wish to discuss it here.

The ureteral orifice is very apt to appear congested, when the kidney above is the seat of disease even slight in character. When the kidney is the seat of inflammation, the changes in the ureteral orifice often become very marked; the most common being, hyperæmia, swelling or eversion of the surrounding mucosa, and contracture of the orifice, which may be changed from a slit to a small round hole, situated at times in the top of the cone-like projection.

The following cases show the diagnostic value of the cystoscopic inspection of the ureteral orifices.

Case I.—The patient, a man, had had symptoms suggesting ureteral calculus of the left side for three years. The radiograph

showed no calculus, and the urine contained so little pus that its source could not be detected by the plain cystoscope. Inspection of the ureteral orifices showed the right to be normal in every way and emitting jets of clear urine. The left ureteral orifice, on the other hand, was distinctly abnormal, the ridge much enlarged, and at the proper location for the orifice. There were numerous small polypoid projections of mucous membrane which floated in the vesical fluid. It was impossible to make out the orifice or the urine coming from it. The bladder was normal. Extraperitoneal operation was performed; the ureter was found markedly enlarged and thickened throughout its entire length, and examination of the kidney showed it to be tuberculous. Nephro-ureterectomy was performed.

In this case the left ureter could be catheterized, and the appearance of the ureteral orifice alone indicated the diseased side. The urine obtained by catheter from the right side was normal. (See complete history, Case II in appendix.)

Case II.—In another case, a male, with indefinite symptoms referable to the left kidney, but in which the urine was normal, the cystoscope showed an extensive bulging of the bladder-wall about a much contracted ureteral orifice. The ureter catheter met with an impassable obstruction just above the orifice. When the ureter was exposed by the extraperitoneal operation, a stone about the size of an almond was found impacted in it just above the bladder. (Case V in appendix.)

In two other cases, however, in which small stones were impacted in the right ureter within four centimetres of its end, the orifice showed no abnormality, but the ureteral catheter and X-ray made it clear that a calculus was present not far from the orifice. (Case VI in appendix.)

In non-infected renal pyuriæ the orifice of the ureter may be normal in appearance, though it generally shows some congestion, and often eversion of its mucous membrane. The prolapsed papillary condition of the orifice, as seen in the first case above, should, in the absence of a detection of a calculus with the ureter catheter or X-ray, always suggest tuberculosis, as should also an enlarged thickened ureter at operation.

Atrophy of one side of the trigone and contracture of the

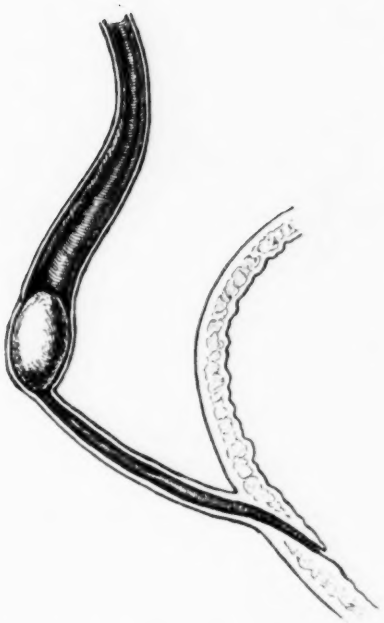

FIG. 3.—Calculus impacted in paraischial portion.

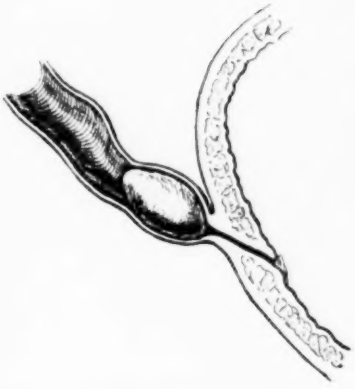

FIG. 4.—Calculus in juxtavesical portion.

FIG. 5.—Calculus in intramural portion.

FIG. 6.—Intravesical ureteral calculus.

FIG. 7.—Intravesical ureteral calculus.

ureteral orifice may be of great diagnostic value, as shown by the following case.

A young man, aged twenty-one years, came to me complaining of a chronic sinus in his left lumbar region, supposed to be due to necrosis of the twelfth rib. His history did not suggest renal disease, and the urine was clear; but in order to make my examination complete, I performed a cystoscopy, and found the left half of the trigone flat, the muscles atrophic, the usual ridge absent, the ureteral orifice of pinpoint size, and no urine flowing from it. The diagnosis of obstruction of long standing was at once made; an X-ray was taken, and showed calculi in the left kidney. The operation demonstrated that the ureter was completely blocked by a pelvic stone, the kidney having been reduced to a fibrous sac. (See appendix, Case III.)

CALCULUS IN THE LOWER URETER.

The ureter has four points of congenital narrowing, viz., below the renal pelvis; where it crosses the brim of the pelvis; at its vesical junction; and its orifice in the bladder.

A calculus which passes the first two may become lodged in either of the last two. Calculi are found elsewhere in the pelvic ureter, especially in its paraischial portion, probably owing to the rather sharp bend made by the ureter at that place. These points of predilection are graphically shown in the accompanying charts, viz., the paraischial, the juxtavesical, the intramural, and the intravesical (Figs. 3, 4, 5, 6, and 7).

In the female, that portion of the ureter lying within the broad ligaments is frequently narrowed by diseases of the female pelvic organs, and furnishes quite a common point for the impaction of calculi.

In the male, calculus of the lower ureter is apparently rare; and in a recent study of the literature I was able to collect only eighteen operated cases, including two of my own.[21] I can now add another case which I have recently operated upon, thus making nineteen cases.

The location of the impaction was as follows: juxtavesical, 8; intravesical, 5; paraischial, 1; intramural, 3;

juxtavesical and paraischial, 1 (three stones); juxtavesical to iliac, 1 (seventeen centimetres long).

Various routes have been employed for the extraction of these calculi, and the results obtained were as follows:

I. Intravesical, 9; result not noted, 3; recovered, 6.
II. Perineal (prerectal), 1; recovered.
III. Intrarectal, 1; died.
IV. Iliac (extraperitoneal), 8; recovered, 6; died, 2.

Total, 19 cases; result not noted, 3; recovered, 13; died, 3.

I.—The intravesical route has been used in the male in three ways: (*a*) through a perineal urethrotomy; (*b*) through a suprapubic cystotomy; (*c*) through the urethra by means of a male catheter cystoscope, and by a lithotrite.

The suprapubic method has been employed in six cases with success in each. In all of these cases the stone was impacted in either the intravesical or intramural part of the ureter. In two, the operator thought he was dealing with a pedunculated intravesical tumor.

Harrison detected with the cystoscope a calculus protruding from the ureter and removed it with the lithotrite. Cystoscopic extraction has been employed once in the female, by Hall, of Cincinnati,[12] who dislodged the stone by means of a probe through a Kelly speculum, and once in the male by the writer.

In my case, the stone, which had given rise to symptoms both renal and vesical for three months, was found protruding from the orifice of the left ureter and dislodged by means of the male ureter catheterizing cystoscope of Casper. The manœuvre is shown sufficiently in the accompanying drawing (Fig. 8). (See appendix, Case IV.)

In the female, intravesical and intramural impactions may be reached through the urethra, or through the vesicovaginal septum. Kelly[9] reports a case of intramural calculus removed by urethrotomy through this route, the patient being in the knee-chest position and the bladder distended with air.

II.—The perineal prerectal route has only been employed by Fenwick,[10] who made a transverse incision in the perineum,

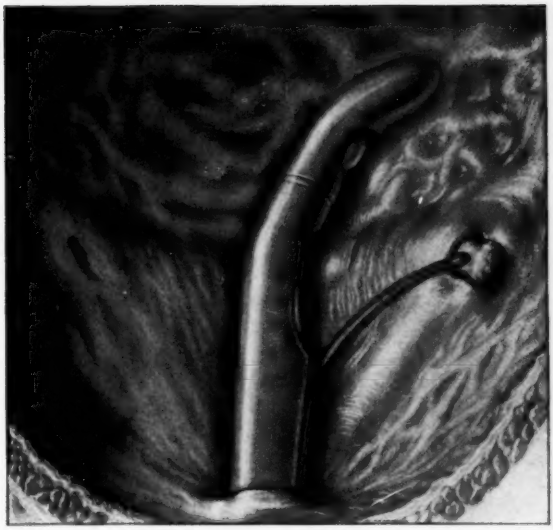

FIG. 8.—Cystoscopic extraction of intravesical ureteral calculus.

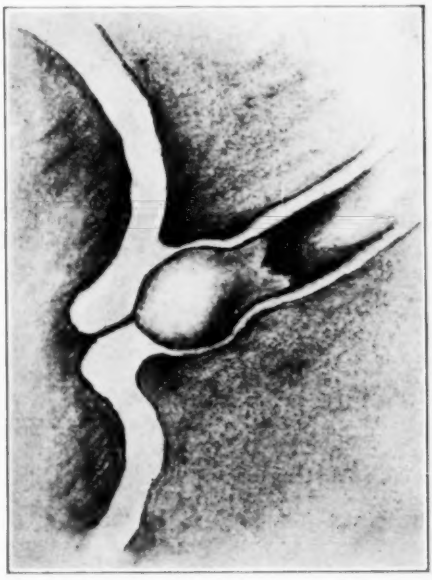

FIG. 9.—Diagram showing the stricture of the intramural ureter with the calculus impacted just above it.

FIG. 10.—The calculus used as a bobbin to place the sutures, after having been pushed up to a point in the ureter above the pelvic brim.

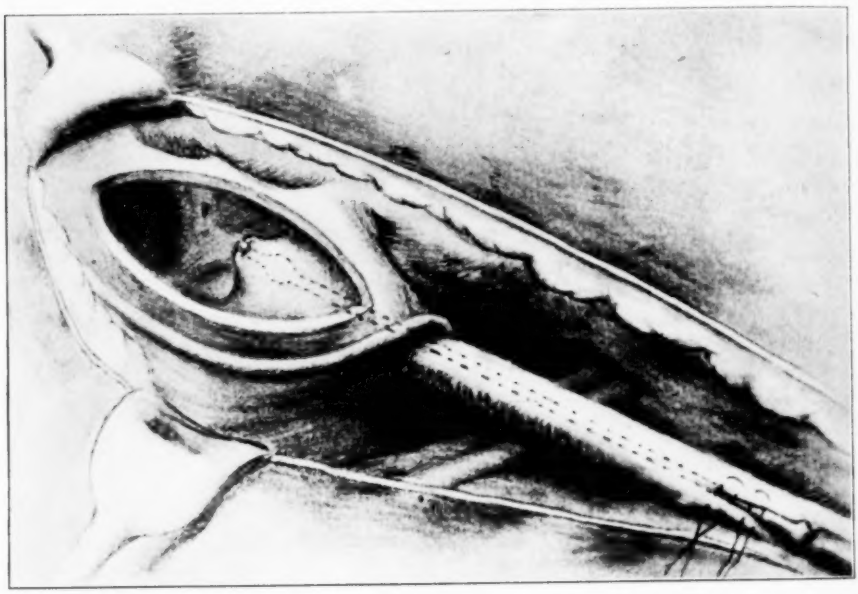

FIG. 11.—Showing the lateral incision into the bladder, the vas deferens, the dilator in the ureter, with its point protruding into the bladder through the stricture.

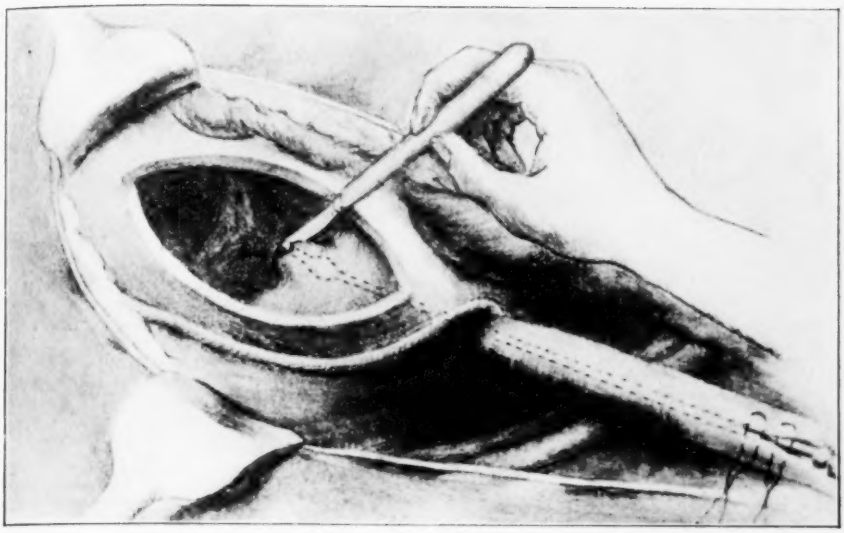

FIG. 12.—Showing the intravesical division of the stricture upon the ureteral dilator.

FIG. 13.—Another diagram showing the division of the stricture upon the ureteral dilator.

separated the rectum from the prostate, and thus exposed the ureter with a calculus impacted in the juxtavesical portion. The stone was removed through a longitudinal incision. The ureter was drained, and the patient recovered.

Fenwick thinks this the method of choice where the calculus is low down in the ureter, but Regnier [11] tried to reach the ureter in this way, but was unable to do so, and had to employ the iliac route.

III.—The intrarectal route has been employed but once, and that with fatal result. It has nothing to commend it.

IV.—The iliac (extraperitoneal) route has been used for the lower end of the ureter in the male nine times by five operators: Twynam, Morris, Israel, Finney, and the writer. These cases have been more severe, as a rule, than those operated on by other methods, and in three cases complete nephro-ureterectomy was done. There were, however, only two deaths.

My first case was that of a man, twenty-nine years of age, who had had symptoms of ureteral calculus for twenty-seven years. The cystoscope showed a bulging of the bladder-wall above the left ureteral orifice, and the ureter catheter met with an obstruction one centimetre above. In the radiograph, the shadow of the calculus, the size of an almond, appeared in the left half of the pelvic space. The calculus was removed extraperitoneally by the iliac route and the ureter sutured. A stricture was found at the intravesical end of the ureter, and, as it could be dilated above, was divided intravesically through the wound in the lateral wall of the bladder (Figs. 9, 10, 11, 12, 13). (See appendix, Case V.)

The second case was a man, aged twenty-five years, who had had symptoms of calculus of the right ureter for five years. The urine was normal, and the cystoscope showed a healthy bladder; but the ureter catheter met with an obstruction about four centimetres above the vesical orifice, and the X-ray demonstrated a small calculus in the right half of the pelvic space. The calculus was removed as in the first case. It was found tightly incarcerated in the ureter about one and one-half centimetres above the bladder. Stricture of moderate degree was present below the calculus and was dilated by bougies. The patient made a

good recovery, and there was no leakage. (See appendix, Case VI.)

These two cases serve to demonstrate the efficacy and simplicity of the extraperitoneal iliac operation. As late as 1898 Fenger [5] asserted that this portion of the male ureter was beyond the reach of the surgeon.

In the female, according to Schenck,[12] ureteral calculi have been extracted through the urethra about eight times with one death, and through the vagina thirteen times with one death. Morris [2] twice removed a calculus from the pelvic ureter in the female through a parallel incision. The incision was made parallel with the sacral spines; the edge of the gluteus maximus and the sacrosciatic ligament were divided, the ureter incised, and the stone extracted. Morris prefers this route to the iliac route in both male and female. The extraperitoneal or abdominal route has been employed several times in the female, but never in the male for this portion of the ureter. This route is quite generally condemned.

The iliac route has seldom been used in the female for extraction of calculi; Israel being a notable exception.

The Choice of Route for Stone in the Lower Ureter.

As outlined above, surgeons are far from agreed on this question. When the stone is intravesical or intramural, all are agreed that it should be removed through the bladder. The simplest means are with the cystoscope, as in the two cases detailed above. If projecting well into the bladder, the lithotrite may suffice to extract it as in Harrison's case. In the female, after dilating the urethra, forceps may be introduced and the calculus withdrawn.

If none of these suffice, or the stone is intramural (and therefore out of the reach of such methods), suprapubic cystotomy in the male, and vaginal cystotomy in the female, after the method of Kelly,[9] should be done. When the stone lies in the juxtavesical ureter,—in the last two or three centimetres which are in close apposition to the vagina,—it can be

easily removed by the vaginal operation. The only objection to the method is the danger of a ureteral fistula persisting, and the inability to inspect and explore the upper ureter and kidney. When the calculus is higher up in the female ureter, various objections to the vaginal operation present themselves, which will be discussed later on.

Calculus in the deep pelvic ureter in the male has received much attention, but there is still little unanimity of opinion in the literature as to the proper method of attacking it.

Cabot,[13] in 1892, deeming the iliac extraperitoneal operation inadequate for calculi of this portion of the male, suggested that the ureter might be reached through a Kraske sacral-flap operation.

Le Dentu held this portion of the ureter to be inaccessible in the male, and in 1898 Fenger endorsed this view.

Writing in 1898, Fenwick[10] said that a calculus below the pelvic brim should be removed by the perineal-prerectal route, which he had employed in one case.

In 1901, Morris[2] said, "when a stone is impacted in the ureter near its lower end, but too far off to be removed through the bladder or the vagina, the sacral route should be employed." In the male he advised the prerectal or perineal route of Fenwick.

Schenck,[12] in 1901, said, "when located within two inches of the bladder, the choice is between the vaginal ureterotomy, rectal ureterotomy, vesical ureterotomy, or perineal ureterotomy."

Thus we see that up to the last year only two published cases of the iliac extraperitoneal operation for stone in the lower pelvic ureter in the male were recorded,—one in a child, the other in an adult, and with fatal result.

The view was generally held that this portion of the ureter could not be reached by the extraperitoneal iliac route, and the French were advising nephrostomy rather than an attempt at removal of the calculus.

Late in 1901 Israel's book[14] appeared. In it were published three cases of calculi removed from the deep pelvic ureter

in the male by the extraperitoneal iliac incision, and four cases in women in which the same route was employed for stones which could be felt per vaginam. In these seven cases Israel had two deaths, one male and one female, both due to heart failure. His cases disproved at once the prevailing opinion that the pelvic ureter was beyond the reach of the extraperitoneal iliac operation.

Before Israel's book appeared in America, Finney and the writer had each successfully removed calculi, which were impacted in the deep pelvic male ureter, by the iliac extraperitoneal route. These cases were reported by the writer in the Transactions of the Philadelphia County Medical Society for March 12, 1902.[21] Since then I have had an additional case.

In each of my cases, although the calculus was incarcerated in the ureter at its vesical juncture, it was readily exposed, dislodged, pushed upward in the ureter to a point above the pelvic brim, and there removed through a small incision, which was easily sutured (Fig. 10).

It has therefore been demonstrated by six cases published within the last year that the deep pelvic portion of the male ureter is just as accessible by the extraperitoneal operation at the upper ureter, and that calculus of even the juxtavesical ureter can thus be removed with ease.

The only other methods which have been employed are the intrarectal, which was used by Ceci with fatal result, and the perineal-prerectal, which is manifestly only suitable for calculi immediately above the bladder, and has several great disadvantages, viz., the inability to examine the ureter and kidney above or to determine the presence of stricture below; the danger of entering the peritoneal cavity, especially when the seminal vesicle is the seat of chronic inflammation, and the inability to suture the ureter after removal of the stone. One operator (Regnier) who attempted to reach the ureter by this route failed, and had to resort to the iliac.[11]

The iliac route, on the other hand, has many advantages, viz., the ability to explore the kidney and the ureter above and below, to dilate or incise a stricture below, as in my case, to

close the ureteral wound by sutures, or to perform nephro-ureterectomy if necessary (as in Israel's case, where the stone was seventeen centimetres long). Considering, then, that the perineal route has only been used successfully once, that at least one surgeon has failed with it, that the wound is narrow, deep, and dark, and the procedure encumbered with numerous disadvantages as outlined above, I cannot agree with Fenwick and with Morris, authorities though they be, in considering it the method of choice in the male, but feel convinced that the iliac route is the only justifiable method.

As to the method of choice in the female, I cannot speak from personal experience. I am aware that a number of cases in which gynæcologists have removed through the vagina calculi from the lower end of the ureter are to be found in the literature, but I am also aware that it has at times been impossible to reach them by this route. Morris himself says that the method is only applicable to stones of the juxtavesical portion and not for those of the paraischial or parasacral portions of the ureter. For these he advises the pararectal route, which he has twice employed in the female out of six cases of calculus of the pelvic ureter in the female.

Israel has only twice successfully employed the vaginal route. In each of these cases the stone was small and lay in the juxtavesical portion immediately adjacent to the vagina. In two other cases, in which the calculus was impacted in the paraischial portion, and therefore separated from the vagina by the intervening subligamentous tissues, all attempts to reach it failed, and he had to resort to the iliac route. In the remaining two cases Israel adopted the iliac route without attempting the vaginal.

These cases show very conclusively that calculus of the pelvic portion of the ureter in the female cannot and should not always be attacked from the vagina. Morris admits this, but advises the use of the posterior pararectal route, which involves a division of the gluteal muscles and sacrosciatic ligament, and requires great care to be taken to avoid injuring important

vessels and nerves. This method is certainly not nearly so simple nor so thorough as the iliac route.

It seems very clearly proven, then, that calculi in the pelvic portion of the ureter in both male and female can be most easily extracted by the iliac route, which is greatly to be preferred, for the many reasons set forth above, to any of the inferior routes, with the possible exception of the juxtavesical portion in the female, in which calculi are very close to the vagina. The frequent persistence of fistulæ after the vaginal incision may yet prove the iliac method to be the most satisfactory for even these cases.

FISTULA OF THE LOWER URETER.

This may be congenital or acquired. The congenital forms have already been described under the subject of anomalies.

The acquired variety is generally due to injuries during childbirth from the obstetrician's forceps, or to prolonged pressure of the fœtal head. A more common cause is instrumental injuries during operations for disease of the female pelvic organs, particularly carcinoma of the cervix uteri. In nearly all cases the fistula opens into the vagina. According to Stoeckel, who has made an exhaustive study of the subject,[15] spontaneous healing occurs in a very small number of cases. The operations which have been employed are as follows:

1. Plastic operations to close the vaginal fistula.

2. Colpocleisis,—closure of the vagina, and thus damming back the urine which escapes into it.

3. Implantation of the upper segment of the ureter into the bladder, the rectum, or skin.

4. Anastomosis of the ends of the ureter divided at operation.

5. Nephrectomy.

Of these methods, colpocleisis, implantation into the rectum and the skin, and nephrectomy are now very seldom employed.

Attempts to close the vaginal opening have been so often unsuccessful, that when anastomosis of the two ends of the

ureter cannot be done, extraperitoneal implantation into the vertex of the bladder seems to be the operation of choice. We have not space here to discuss the pros and cons of the various procedures, and the reader is referred to the exhaustive studies by Petersen,[16] Kelly,[17] Bovee, Stoeckel,[15] and others.

TUMORS.

Involvement of the lower ureter by neoplastic growths occurs not infrequently in tumors of the bladder. Primary tumor of the lower end of the ureter must be extremely rare, as I can find no recorded case. When the renal pelvis and upper ureter are the seat of papillomatous growth, the lower end may also become involved, as in a case of mine in which I found a polypoid tumor projecting around the ureteral orifice into the bladder, and a large tumor of the kidney present. On the other hand, the orifice of the ureter is very commonly involved in vesical neoplasms. Israel [14] says that the ureteral papilla is the place of predilection for the development of cancer of the bladder, and the contracture of the orifice, with consequent dilatation of the renal pelvis, occurs quite soon, as a rule. He reports one case in which the ureteral orifice was surrounded by a carcinomatous growth, in which he excised the tumor with a portion of the ureter, the proximal end of which he transplanted to another part of the bladder, with good result. A portion surrounding the ureteral orifice may be excised without necessitating the transplantation of the ureter, as in the following case in my practice.

A male, aged sixty-five years, had suffered with intermittent hæmaturia for four years. On cystoscopic examination I found a large globular, pedunculated tumor covering the right ureteral orifice. Suprapubic incision was made, and the tumor was found to spring from the region of the right ureteral orifice by a short pedicle, two centimetres thick. After clamping the pedicle, I cut it off below the clamp with the cautery, ligated a few bleeding points, and closed the bladder with drainage. Cystoscopic examination thirteen months later showed no return of the growth. (See appendix, Case VII.)

VALVE FORMATION.

Although Fenger was able to collect a number of cases of valve formation at the upper end of the ureter, I can find only one reported case for the lower end. This is a case which has just been reported by Morgan.[18]

His patient, a man aged twenty-one years, had had intermittent attacks of pain in the left loin for four years. At operation a large dilated ureter was found, and on following it downward a constriction was encountered one and one-half inches above the bladder. The obstruction was thought to be due to some local inflammatory action forming a band-like adhesion around the ureter. Above this point the ureter was dilated, forming a posterior sacculation. Within this he found a transverse fold of mucous membrane, which closed the opening of the lower ureter like a valve, thus preventing the free outflow of urine.

Three operations were performed; the operator finally finding it necessary to open the bladder twice through a suprapubic incision, and the ureter three times through the iliac extraperitoneal before he was able to cut the valvular fold and provide free exit for the urine. The vesical incision was used only to pass the catheters up the ureter, the valve being divided with scissors through the iliac wound.

Morgan offers the following explanations: "The inflammatory bands impeded but did not totally obstruct the flow of urine. This led to a gradual pouch formation, which finally became of such size as to make a sharp angular deformity at the place of most dense adhesion, and this angular deformity led to a valvular mucous fold which intermittently completely shut off the ureteral current." The kidney was thus not destroyed.

STRICTURE.

Stricture of the lower ureter has only recently attracted any attention. In a recent paper on the subject, Kelly [22] states that practically nothing has been said in the literature about stricture of the lower ureter.

I have not the time here to discuss the various causes of stricture of the ureter, and will have to omit the numerous affec-

tions of the female pelvic organs which may diminish the caliber of the ureter by pressure, or by a direct infiltration of its walls, and devote myself entirely to the simple strictures of the lower end. These may be produced by scar tissue around the vesical orifice or by inflammation of the walls of the ureter itself. Stricture of the latter variety may follow the laceration produced by the passage of calculi. The irritation caused by an impacted calculus is very apt to lead to the production of stricture below it.

Kolisher, Casper, Kreissl,[19] and Kelly have reported cases of stricture of the ureter which have been treated by dilatation with ureteral catheters, thus permitting the subsequent passage of small calculi.

In a careful study of the literature, I find only two cases of operation for stricture of the lower end of the ureter. I do not include that reported by Meyer,[20] which was really one of calculus, but will give a brief abstract of his interesting case.

A man aged twenty-three years had five years before suffered with renal colic on the left side. After that he had little trouble, except a slight pain in the bladder at the end of urination. On cystoscopic examination the left ureteral mouth appeared swollen and ragged, the left ureteral fold more prominent than normal, projecting like a small tumor into the bladder. No fluid was seen coming from it. The ureter catheter met with an obstruction about one-half inch above the orifice, but the right ureter was catheterized easily and gave normal urine. A diagnosis of stricture of the left ureter near its vesical end and renal calculus was made. At operation the kidney looked healthy. There was no stone present in the pelvis, but a ureteral stricture was found six inches below the kidney. Four days later the kidney was extirpated. The wound healed well, but the patient continued to suffer pain, and the urine was purulent. Dr. Meyer then operated a third time and removed the ureter. "When about to tie off the lower portion at its entrance into the vesical wall, a stone of about the size of a large pea was found firmly wedged in the ureter just above the ureteral mouth. It was dislodged and removed with the entire ureter." The patient made a good recovery. It was not definitely determined that a stricture was present.

The first case of simple stricture was that of Israel,[14] who reports the case of a woman on whom he performed nephrolithotomy. On passing a bougie down the ureter he discovered a tight stricture just above the bladder. Nothing further was done to the stricture, and the kidney was drained. Afterwards attempts were made to dilate the stricture by catheterizing the ureter through the cystoscope, but without success, and, as the fistula still persisted eight months later, a second operation was performed, and the ureter explored extraperitoneally down to its vesical juncture. The stricture was found to begin at a point three centimetres above the bladder and to extend down to the entrance of the ureter into the vesical wall. The ureter was severed close up to the bladder, and the strictured part resected. The bladder was then opened on a sound high up on its posterior wall, the ureter cut obliquely, and its mucous membrane sutured to the mucous membrane of the bladder in one angle of the vesical incision. The rest of the bladder wound was then closed. The result was excellent. Before the renal fistula closed, Israel showed, by inserting a catheter into the ureter through the fistula and filling the bladder with fluid through the urethra, that none would flow back through the new ureteral wound unless the catheter was pushed into the bladder,—thus demonstrating that the orifice had a valve-like mechanism. Study of the specimen showed that the stricture was impermeable.

The second case was reported by the writer [21] in March, 1902. A man aged twenty-nine years, with symptoms of ureteral calculus since the age of two years, was found to have a large calculus impacted in the ureter at its vesical juncture (Fig. 9). This was removed by the extraperitoneal iliac route; but after its extraction, an impermeable stricture was found in the intramural course of the ureter just behind its vesical orifice (Fig. 13).

Many attempts were made to dilate this, but it was found impossible to pass even the smallest probes through its lumen. I therefore decided to divide the stricture within the bladder, which I accordingly exposed on its left lateral wall (through the original iliac incision), having to dislocate the vas deferens downward out of the way before incising the bladder (Fig. 11). After the bladder had been opened and the fluid evacuated, several attempts were made to pass a probe into the ureter from the bladder, but it was found impossible to push it farther than one

centimetre. Working with the bulbous dilator through the ureter from above, and making counterpressure in the bladder by covering the orifice of the ureter with the end of the index-finger, it was finally possible to push the small end of the dilator through the stricture until its point appeared in the bladder, as shown in Fig. 11. Around the dilator one could easily feel a hard fibrous ring about four millimetres thick. As all attempts to pass even the smallest instruments had failed, I decided to cut the stricture from within the bladder, and this was successfully accomplished by a long-handled scalpel, as seen in Fig. 12, and as fully described in the appendix, Case V. The largest ureteral dilators were then easily passed into the bladder. The lateral vesical wound was closed, and the patient made a rapid recovery, no leakage of urine occurring. The cystoscope, six months later, showed that the divided ureteral orifice had remained slit-like and pervious.

The method used in this case would possibly have been applicable to Meyer's case if a stricture was present below the calculus, and the kidney thus have been saved. In Israel's case the stricture was too high up and transplantation was the proper operation.

In another case (appendix, Case VI), after removing a calculus from its impaction one and one-half centimetres above the bladder, I found below it a stricture of the ureter, but it was easily dilatable, and the intravesical operation was not necessary.*

The cases referred to above show the necessity of sounding for stricture of the lower ureter in all cases of ureteral calculus, or when the calculi have previously passed through the ureter, for unquestionably the breaking down of sutured ureteral wounds and the persistence of urinary fistulæ are often caused by the presence of undiscovered strictures of the ureter below.

* April, 1903. I have recently operated upon a case of stricture of the ureter caused by inflammation of the right seminal vesicle which involved the juxtavesical ureter. The ureter and kidney were so badly dilated and inflamed that nephro-ureterectomy had to be done. The lower end of the ureter was found tightly bound to the upper end of the seminal vesicle, and its lumen reduced to a very small caliber by a dense stricture one centimetre long. Recovery.

It will generally be easy to dilate them with successive bougies, but when all such attempts fail, and the stricture is of the intramural portion of the ureter, the operation employed in my case may be done. The technique is simple, and the exposure obtained through the lateral cystotomy wound excellent. Its use in Morgan's case would have done away with the extra suprapubic incision (see Valve Formation and [19]).

When the stricture is just above the bladder, in the juxtavesical portion, transplantation by the method employed by Israel should prove satisfactory. Even when the stricture is situated several centimetres above the bladder, the ureter may be implanted into the vertex of the bladder if this is large enough to allow its being drawn upward some distance, and thus make up for the shortened ureter. In such cases, however, resection of the stricture with end-to-end anastomosis of the ureter, or the plastic described by Fenger (longitudinal division of the stricture, with transverse closure), might be employed; but such cases do not come within the scope of this paper, which is intended for lesions of the lower end only.

APPENDIX.

REPORT OF CASES IN FULL.

CASE I.—*Intravesical Balloon Formation at the End of the Left Ureter.*

J. W., aged forty-nine years. Complaint, burning on urination; swelling of testicles. No history of tuberculosis. Gonorrhœa thirty years ago.

Fourteen months ago, without apparent cause, blood escaped from the urethra during an interval between urinations. Has not noticed any subsequent bleeding, but since then urination has become more frequent and irritating. He now has to get up three or four times every night to void urine. He does not know when the testicular swelling began.

Examination.—A thin, rather anæmic man. Chest rather symmetrical. On auscultation the fronts are clear, except for an occasional dry crackle of pleural origin in the lower fronts. Heart

normal. Abdomen negative. No tenderness in the region of the kidneys, nor in the hypogastric region.

Genito-Urinary Examination.—The urethral meatus is reddened, but no discharge is present. There is a small hydrocele of the right side; the epididymis presents a nodular mass in the globus minor. The testes seem normal.

Rectal examination shows considerable enlargement and induration of the right lobe of the prostate. The left seminal vesicle and vas deferens are enlarged, indurated, and tender. The right is not palpable.

Urine.—Albumen very abundant. Microscopically, pus-cells and tubercle bacilli present in great numbers.

Cystoscopic examination revealed very peculiar intravesical changes. The right half of the bladder was perfectly healthy in appearance, and the ureter on that side was normal. On the left side, over an area extending from the ureteral orifice around and behind the left ureter, outward along the left lateral wall, and also a portion of the anterior wall of the bladder, the mucous membrane was markedly changed, of a general deep-red color, individual vessels not visible, and the surface rough, thrown into folds.

The cystoscopic picture was an unusual one for tuberculosis, showing itself more as thickening and congestion of the mucosa without definite ulceration.

The Left Ureter.—While hunting for the mouth of the left ureter, a very peculiar smooth, glistening, round tumor of the size of a small grape was seen, but was soon lost sight of. The left ureteral ending was then found, appearing as a fine pin-point opening, lying in a wrinkled mass of mucous membrane. While watching for the urine to spurt from the orifice, the small, round tumor suddenly appeared, and then as rapidly disappeared.

On further study it was found to rise up like a balloon at intervals of about twenty seconds, carrying with it the ureteral orifice, from which the urine was ejected in a fine forcible stream. The balloon would remain fully distended as long as the flow of the urine from the orifice continued, and then it would suddenly collapse into a mass of wrinkled mucous membrane. The orifice of the right ureter was normal.

CASE II.—*Papillomatous Ureteritis associated with Stricture*

at the Orifice of the Left Ureter. Tuberculosis of Kidney. Nephro-ureterectomy. Cure.

R. A., aged thirty-five years; male. Complaint, pain in the left side and back. Family history negative. Past history unimportant; has never had gonorrhœa.

Present illness began three years ago, with an attack of severe pain beginning in the left lumbar region, and radiating from there downward into the left groin and to the end of the penis. This attack lasted about one-half hour, and the patient remained free from pain for about two weeks, when another attack similar to the first came on. Since then these attacks have come on at intervals varying from two days to a week or more. They were always similar in character, were never associated with hæmaturia nor pyuria (according to the patient), and no calculus has ever been passed. Of late he has had fever and night sweats, and micturition has become more frequent, occurring about every two or three hours.

Physical Examination.—A healthy looking man; lips of good color; no arteriosclerosis. Chest well formed; lungs and heart negative. Abdomen full and rather fatty, and examination therefore unsatisfactory. Neither kidney palpable, and no tenderness on deep pressure over them nor along the course of the ureters. Genitalia normal; no urethral discharge.

Rectal Examination.—Prostate and seminal vesicles indurated and tender, but the secretion obtained by prostatic massage is practically normal and contains no pus-cells. No enlargement of the left ureter can be made out.

Urine.—All three glasses cloudy. Microscopically, pus-cells; no bacteria present (later, tubercle bacilli were found).

Cystoscopic Examination. Nitze plain cystoscope easily introduced. There is a moderate amount of inflammation present in the region of the trigone. The orifice of the right ureter is normal in appearance, and from it there are emitted spurts of clear urine. The region of the left ureteral orifice is distinctly abnormal; the ureteral ridge is much enlarged, and at that point where the orifice should be there are numerous polypoid processes of mucous membrane which wave to and fro in the vesical fluid. The ureteral opening cannot be seen, and no fluid is seen spurting from that side.

Ureter Catheterization.—Casper's instrument introduced, and

the right ureter catheterized with ease. The urine collected from it contains a few blood-corpuscles, but is otherwise normal. It is impossible to catheterize the left ureter, the orifice of which is hid among the polypi described above. Although the catheter has been pushed among these in various directions, the point fails to engage, and it is evident that a stricture is present.

Note.—The appearance of the left ureteral orifice made it evident that there is considerable disease of that ureter above, probably associated with renal lesion. Tubercle bacilli have not yet been demonstrated. Several X-ray pictures were taken with negative results. Although the diagnosis was therefore inconclusive, the cystoscopic demonstration of the left-sided urethritis with stricture, taken along with three years' history of intermittent attacks of pain in the region of the left kidney, was sufficient to render operative exploration advisable.

Operation.—On October 1, 1902, the left ureter was exposed extraperitoneally through the lower half of Israel's incision. It was considerably enlarged (one centimetre thick), and its walls were thick and hard. This condition extended down to its juncture with the bladder and up to the kidney. There was no calculus present. In order to explore the kidney, the wound was enlarged upward. There was no thickening of the fatty capsule, but the kidney was congested, enlarged, lobulated, and at its lower pole focal areas of suppuration were present.

Complete nephro-ureterectomy was performed, the ureter being divided, after ligature with catgut, in its juxtavesical portion.

The patient made a good recovery. The specimen showed miliary tuberculosis of the kidney, pelvis, and ureter.

CASE III.—*Chronic Sinus of the Left Side supposedly due to Necrosis of the Ribs. Cystoscopic Demonstration of Atrophy of Left Side of Trigone Contracture of Orifice of Ureter, and Absence of Urinary Function. Operation: Kidney found destroyed by Calculi. Nephrectomy. Cure.*

S. C. W., aged twenty-one years; male. Referred by Dr. Hicks, of San Antonio, Texas. Complaint, "running sore on back." Family and past histories negative. No typhoid. No cough. Present illness. Patient says his mother tells him that at the age of four years he began to have attacks of pain in the

left side, which was followed by considerable swelling there, but would gradually subside. From this time until sixteen years old these attacks came on at intervals varying from one to several months, and although the swelling was at times considerable and the skin looked red, "no abscess formed." Between attacks he would often have a dull aching pain beneath the ribs and in the left lumbar region. In May, 1897, after an attack of dysentery, a severe "attack" came on, and his physician found that an abscess had formed which required opening. A large amount of pus was evacuated. Since then a fistula has persisted at the site of the incision, for which he has been operated upon twice, the diagnosis of necrosis of the rib having been made, but no good has resulted. During the past four years (since the beginning of the fistula) he has been free from the attacks of sharp pain, but there has been a dull ache present in the region of the left sacro-iliac synchondrosis.

There have never been any urinary symptoms, with the exception of one month in 1891, when he suffered with incontinence of urine and vesical irritability. He says his urine has always been clear, and that he had never passed a calculus. He voids his urine at normal intervals, and complains only of the persistence of the fistula and the pain in the left sacral region. He has never had any form of paralysis. Since the abscess was opened, nothing but a small amount of pus has escaped from the fistula.

Examination.—Patient poorly nourished, anæmic, very nervous. Pulse rapid, but heart sounds normal, lungs negative. The right kidney is movable and larger than normal. The left kidney cannot be felt. There is no tenderness on deep palpation over it or along the course of the ureter. Beneath the middle of the twelfth rib on the left side is a sinus, into which a probe passes upward and inward for five centimetres. There is no roughness elicited by the probe.

On rectal examination the prostate seems normal in size; the seminal vesicles are not palpable. Urine clear, no shreds; acid, 1020, no albumen, no sugar. Microscopically negative.

Note.—Although there was very little in the history to suggest renal disease, cystoscopic examination was performed more from the desire to make the examination complete than from the hope of finding anything abnormal.

Cystoscopic Examination.—The vesical mucosa is normal in

appearance, but there is a marked difference in the two sides of the trigone and their respective ureters. On the right side the trigonal muscles are about normal in size; large jets of urine are frequently ejected from the ureteral orifice, accompanied by active contraction of the muscles of that side of the trigone and the ureteral ridge above. On the left side, the edges (or boundaries) of the trigone cannot be seen; the ureteral orifice is much contracted,—pin-point in size, flat with the surface, the lips being absent; there is no intermittent contraction of the muscles of that side of the trigone or of the ureteral ridge to be seen, and no urine is coming from the ureter.

Remarks.—The contrast was so marked, the pictures of the two sides so different,—the right ureter surrounded by hypertrophied muscles and secreting abnormally a large amount of urine, the left not functionating at all, its orifice and surrounding muscles atrophied,—that a diagnosis of calculus of the left kidney with long-standing blocking of the ureter was made. The lumbar fistula was thus explained.

Several radiographs were then taken by Dr. C. Deetjen and, much to our satisfaction, showed five shadows of varying size in the region of the left kidney.

On October 28, 1902, I removed the kidney by the lumbar route. The fistula was found to lead past the ribs to the kidney, which was much smaller than normal, the cortex being almost entirely destroyed, and merely forming a sac for the contained calculi. There was so much perirenal fibrous tissue that the nephrotomy was extremely difficult, requiring preliminary resection of the twelfth rib. The ureter was completely blocked at its upper end; below that it was abnormally small, thin, and empty. The patient made an uninterrupted recovery, and returned home well.

CASE IV.—*Calculus impacted in the Intravesical Orifice of the Left Ureter. Detected by the Cystoscope and extracted by Means of a Ureter Catheter.*

S. B., aged thirty-one years; male. Admitted to the Johns Hopkins Hospital July 8, 1901. Complaint, "kidney trouble." Family history. Patient's mother is supposed to have died of stone in the bladder.

Past history. About seven years ago, the patient, in good health at that time, was suddenly seized by a severe pain in the

region of the left kidney. This lasted about an hour and was relieved by morphine. There were no other symptoms during the attack that the patient noticed. Six months later sudden and severe pains attacked the patient in the left kidney, accompanied by vesical tenesmus, painful and frequent micturition, the desire not being relieved by passage of urine, and pain along the urethra often radiating to the end of the penis. These symptoms persisted about a week with more or less severity and then gradually disappeared. Since then patient has had no decided attacks, though at irregular intervals he was troubled by slight pain and discomfort in the left kidney.

Present illness. During the first week in April, patient was seized with a severe pain in the left kidney, which continued for several hours, and was only relieved by morphine. This was accompanied by other symptoms, but two days later the patient felt the pain about the neck of the bladder, and had a constant desire to micturate, the act giving him no relief. He also suffered from severe pain at the end of the penis. At times he urinated freely, but at others something seemed to keep the water from coming. Crises of pain usually occurred twice in the twenty-four hours. These symptoms have continued up to the present time, though the kidney pain has lessened, while that about the neck of the bladder has increased, and he now has an almost constant pain in the end of the penis, and twice during the day he has had a colicky pain in the left side.

Examination.—Patient a strong, well-nourished man. Heart and lungs negative. Abdomen held tense, rendering palpation difficult. Liver, spleen, and kidneys are not palpable. Genitalia. Left testicle is markedly retracted (of recent occurrence). Penis normal, but meatus quite small. Rectal examination. Prostate a little enlarged; there is a distinct tenderness chiefly up in the median line, pressure causing great pain, and slight induration is felt at the tender point. A searcher passed into the bladder detected no definite stone, but a slight grating sensation was present. (This was followed by a chill and pyrexia of 105° F.)

On admission, the patient's urine was acid, 1018, no sugar, a trace of albumen, white and red blood-corpuscles, calcium oxalate crystals; no bacteria seen.

July 9, 1901. A meatotomy was done to allow more room for a subsequent cystoscopic examination.

July 19, 1901. *Cystoscopic Examination.*—Detection of small calculus impacted in the left ureteral orifice. Calculus dislodged by instrumentation with ureteral catheter and Casper's cystoscope.

The patient was prepared for an aseptic examination, and after careful irrigation of the bladder the Nitze cystoscope was introduced. The bladder was found to be normal. The prostate showed no intravesical hypertrophy. The right ureter was normal in appearance, functionating regularly, and the urine ejected was clear. In the region of the left ureteral orifice a small, irregular mass projected into the bladder cavity. At first it looked like a mass of fibrin, but after repeated washings of the bladder it was seen to be a small, dark calculus, which was caught in the mouth of the ureter. The surface of the calculus was very irregular and several small, sharp processes were seen. It appeared to be three to four times as large in diameter as the end of the ureteral catheter, though it was not spherical in form. It did not completely fill the ureteral orifice, and to one side there was a patency through which a fine stream of urine was ejected. The ureteral ridge was considerably enlarged, apparently indicating that the ureter was dilated.

An attempt was now made to pass a ureteral catheter into the small opening left by the incomplete blocking of the calculus of the orifice, but in so doing the stone was pushed back into the ureter for a short distance, leaving a round, patulous ureteral orifice with thickened edges. On withdrawing the catheter the stone followed it, again presenting itself at the ureteral orifice, but there lodged. It was now decided to attempt to dislodge the stone by lateral pressure with the end of the catheter, *i.e.*, to prize it out of the ureter if possible. The prism of the catheterizing cystoscope was therefore placed near the stone and the catheter made to lie in a direction at right angles to that of the ureter, and with the tip of the catheter against the side of the calculus. *Pressure was then made against the calculus by pushing the catheter, but the former was held so tight in the ureteral orifice that it only swayed to and fro under the force exerted on it, but was not dislodged. After several exciting attempts, strong lateral pressure was obtained closer to its point of detention, and the calculus was finally prized out of the ureter and fell to the floor of the bladder, leaving a large hole,—the dilated ureteral orifice.* This manœuvre caused considerable hæmorrhage from the ureter

and prostate, so clouding the fluid in the bladder that the cystoscope failed to locate the stone in the bladder. Bigelow's evacuator was now used without success, and the patient was returned to the ward, with the instructions to preserve and filter all the urine he passed. Patient says that he was immediately relieved by the cystoscopic instrumentation of the pain which he had suffered, and has had none since. A slight chill and rise of temperature followed instrumentation.

July 11, 1901. This morning, about forty hours after the cystoscopic examination, the calculus was passed during urination. It is of dark brownish-black color and about six millimetres in diameter and three millimetres thick, the surface is rough with sharp, irregular processes and spicules. There was no pain produced by its passage through the urethra, and, in fact, the patient was not aware that it had escaped until it was found in the urine voided. The patient says that he has had no return of pain in bladder, penis, or kidney since the cystoscopy.

July 12. Patient has for five days suffered with pyrexia, which began with a chill following searching the bladder for calculus two days before cystoscopy. To-day a definite epididymitis is present. There is no pain in the bladder or kidney.

July 17. Patient is still free from pain, except that in the epididymis, which is not very slight. The urine is slightly cloudy and contains cocci and bacilli, but no red blood-corpuscles.

Cystoscopic examination shows a slight acute cystitis. The orifice of the left ureter is still large and gaping, but smaller than before.

No stone is present. Patient discharged.

March, 1901. Patient returns for examination; says he has had no return of renal colic. Examination with cystoscope shows the left ureter much smaller than when last seen. No calculus present.

CASE V.—*Calculus impacted in Left Ureter for probably Twenty-seven Years. Removal by Extraperitoneal Ureterolithotomy through an Iliac Incision. Lateral Cystotomy and Intravesical Ureterotomy for Stricture of the Intramural Ureter. Cured.*

W. B., aged twenty-nine years, married, on August 28, 1901, consulted me for bladder and kidney trouble. Past history. Had gonorrhœa eleven years ago, a fairly mild attack, but accompanied

with epididymitis. He thinks he was completely cured. Has never had any serious illnesses.

Present illness. Ever since childhood has had more or less constant pain in the region of bladder and left kidney. Patient thinks this began when he was about two years of age, and has never been entirely free from it during these twenty-seven years. There has generally been a dull aching pain more or less constantly present in the region of the bladder, and a sore feeling in the region of the left kidney. At intervals of two weeks or more he has had attacks of pain of great severity located in the neck of the bladder and radiating from there along the urethra to the glans. At times the pain is also severe in the left lumbar region. There has never been a retraction of the testicle. These attacks often come on suddenly and last for two or three days; they are always accompanied by hæmaturia and never by frequency of urination.

The attacks as outlined above have continued up to the present time. He has now a dull aching pain in the region of his bladder, and the soreness extends up to the left kidney. These symptoms are sufficient to give him considerable discomfort all the time. He has no sharp attacks of colic, and micturition is apparently perfectly normal.

Examination.—Patient is a well-nourished man; lips of good color; heart and lungs negative; no tenderness in the region of the left kidney nor along the ureter. Genitalia normal, no urethral discharge, urine clear, no shreds, very acid in reaction. Microscopically negative. Prostate per rectum somewhat enlarged; there is a nodule in the region of the ejaculatory duct, nothing abnormal felt above the prostate, and no tenderness.

September 3, 1901. Urine to-day is slightly reddish in color, and under microscope red blood-corpuscles are found.

September 4. *Cystoscopic examination. Catheterizing of ureters, discovery of a stricture of the left ureter.* The mucous membrane was everywhere normal except in the region of the left ureter. The end of the left ureter was located in a considerable ridge. This ridge was much larger than normal. Just to the outside of the mouth of the ureter, which was round in shape and much smaller than normal, there was a deep depression in this ridge. To the outside and back of this the ureteral ridge projected far into the bladder almost as a septum, on each side of which

was a fairly deep pouch, around which the bladder-wall was considerably trabeculated. The mucosa along this ridge, and especially in the region of the ureter, was very red in color, and much rougher than normal. The right ureter and region around it were normal in appearance. The Casper ureter cystoscope was then introduced and the catheter inserted into the mouth of the left ureter. Almost immediately the mucous membrane of the ureteral opening became invaginated, and seemed to be drawn along by the catheter, which would only pass for a short distance (about one centimetre). Several attempts were made to introduce the catheter farther, but without success, and no urine was obtained from it. The conclusions reached in regard to the left ureter was as follows: The lower end was strictured. The ureter just above it (the intramural portion) was much dilated, producing the bulging of the bladder-wall over it, in which a stone probably lay.

The right ureter was normal in appearance and the catheter entered easily, but would only proceed for a distance of about four centimetres, when the same invagination occurred (probably owing to a congenital narrowing). A small amount of urine was obtained from this ureter, showing nothing abnormal except a few red blood-corpuscles, which were thought to be due to traumatism.

September 15, 1901. An X-ray photograph taken by Dr. C. Deetjen shows a distinct shadow of a calculus in the region of the left ureter, at about its junction with the bladder. The shadow is two centimetres long by one and one-half centimetres wide, and oval in shape. It is seen just to the side of the shadow of the coccyx, about two centimetres from the median line of the pelvis. There is no other stone to be seen. Another plate taken higher up shows a larger shadow for the left kidney than for the right, but no calculus. An X-ray plate taken by Dr. Sampson, of the Johns Hopkins Hospital, shows a calculus of the same size, and in the same location in the pelvis, as described above. The shadow here is seen about three centimetres to the outside of the median line opposite to the tip of the coccyx.

October 15, 1901. The patient has been under observation for six weeks. During this time he has had an almost constant dull aching pain in the left kidney, and a pain of a little greater severity which he says is deep-seated and apparently located back

of the symphysis pubis, and from there at times extends along the neck of the bladder to the end of the penis. Micturition has no effect upon these pains, and is of normal frequency.

During this time blood was at times present and at others absent. On September 13 the hæmaturia was considerable. When free from blood the urine contained no albumen.

Operation, October 16, 1901.—Extraperitoneal Ureterolithotomy. Extraction of a Stone from the Juxtavesical Ureter. Ureteral Wound closed. Lateral Cystotomy. Intravesical Ureterectomy for Stricture of Intramural Ureter. Closure of Bladder. Cured.

The abdominal incision, seven inches long, was made from a point about the middle of Poupart's ligament, upward and outward, passing about an inch from the spine of the ilium. As soon as the peritoneum was reached it was elevated by the fingers, and the stripping process carried rapidly downward over the iliacus and psoas magnus muscle and the iliac vessels easily exposed. Search was then made for the ureter, bearing in mind the fact that it was generally to be found adherent to the elevated peritoneum. The peritoneum was found very much thickened, and the tissue greatly changed by fibrous hyperplasia. Nothing simulating the normal ureter could be found, but in the place where it should be a large coil of about the size of a small intestine was found. On account of its great size and because it seemed to be intraperitoneal, this was not supposed to be the ureter until after the wound had been carried upward and outward exposing the kidney. The pelvis was found greatly dilated, and coming from it a very greatly dilated ureter was found. This proved to be that which was before supposed to be the intestine. The ureter was two and one-half centimetres in diameter and considerably convoluted. It was separated by blunt dissection from the peritoneum to its junction with the bladder, at which point a stone was felt (Fig. 9), and after some little pressure against its deepest end with the finger, this was dislodged, and gradually pushed upward in the ureter until it reached a point about five inches from its lower end. Drawing the ureter taut around it and using the stone as a bobbin (Fig. 10), two mattress sutures of fine silk were placed in the ureter over the stone. An incision was then made and the stone removed. It proved to be a calculus two centimetres long, one and one-half centimetres wide, and one and one-fourth

centimetres thick. It was very hard and generally smooth, and showed broad grooves which had been worn away by the urine. The stone was apparently composed of alternate layers of urates and oxalates. After removing the stone from the ureter a metal probe was inserted, and search was made for other stones upward and downward in the ureter, but none were found. Attempt was then made to pass the probes, catheters, and the ureteral dilating instrument devised by Dr. Kelly through the lower end of the ureter into the bladder, but without success.

Operation for the Stricture.—The points of small instruments apparently engaged in its lower end, but would not pass into the bladder. Remembering the fact that it was impossible to pass a ureter catheter for more than a short distance into the ureter during the previous cystoscopic examination, it was decided to make an opening into the bladder, and then dilate or incise the stricture from within the bladder. Another reason for dilating this stricture was that it was found impossible, by squeezing and milking the ureter, to force the urine, with which the part below the incision was distended, into the bladder and thus empty it. It was thought best to make an incision into the bladder along its left side rather than to make a new suprapubic opening in the median line. In order to do this, it was necessary to free the vas deferens from the bladder, and to push it downward so as to make an incision above it into the bladder (Fig. 11).

After the opening had been made, the fluid evacuated, and the bladder dried, several attempts were made to pass a probe into the ureter from below, but it was found to be impossible to push it more than one centimetre. Working with the small bulbous dilator of Kelly through the ureter from above, and with the finger making a counter-pressure into the bladder covering the end of the ureter, it was finally possible to push the small end of the dilator through the stricture until it appeared in the bladder (Fig. 12). Palpation with the finger then showed a distinct hard ring about one centimetre distant from the orifice of the ureter, completely encircling its caliber, and of such strength as to prevent one from pushing the bulbous part of the dilator through. The caliber of the stricture was apparently about three millimetres and the thickness of the ring about four millimetres. The very smallest Kelly dilator was next tried, but with the same result, *i.e.*, the instrument would pass until the bulbous enlargement

came against the stricture, and its point appeared in the bladder, but would go no farther. *It was then decided to divide the stricture with a knife, and an incision was accordingly made along the dilator through the mucous membrane of the bladder into the stricture until it was divided, and the instrument could pass freely into the bladder.* The incision required was probably one centimetre long, and had to be made while keeping the knife against the dilator in the ureter (Figs. 12 and 13). The largest dilators and catheters were then easily passed into the bladder through the ureter from above. The incision in the bladder was closed by eight mattress sutures of fine silk, the edges of the wound being inverted. The ureter was also closed with three mattress sutures of fine silk. Two small gauze drains were inserted to provide for possible leakage of the sutured ureter and bladder.

The muscles and fasciæ were closed with mattress sutures of silver wire, and the skin closed with subcutaneous silver.

November 6, 1901. Patient's condition excellent since operation. The urine, which was at first bloody, is now almost clear. The wound was dressed to-day and a portion of the gauze drain removed, and the subcutaneous silver sutures taken out of the suture wound. Wound healed per primam.

November 13, 1901. The remainder of the drain was removed, there has been no suppuration, and at no time any leakage of urine from either the ureteral or vesical wounds.

November 21. Abdominal wound has healed completely, and patient is in excellent condition. Discharged from the hospital. He is apparently perfectly relieved.

March 7, 1902. Patient says that he has been in splendid health, and had no pain at all in the region of the bladder, ureter, or kidney, and urination is of normal frequency; his urine has been perfectly clear, and he has gained about twenty pounds in weight. Left kidney and ureter not palpable nor tender. On rectal examination a small mass is felt above the seminal vesicles (probably the cicatrix of the ureteral operation). Prostate still somewhat indurated. Urine perfectly clear and normal.

Cystoscopic Examination.—Bladder healthy, right ureter apparently normal, and functionating frequently. The left ureteral orifice is in the shape of a crescent with concavity downward and about three times as long as normal. At the outer end of the crescent a small aperture is to be seen through which the urine

comes. The usual peristaltic wave is not to be seen, but a fairly forcible jet of urine separates the edges of the outer part of the orifice. In the inner two-thirds the lips of the orifice are approximated and are not separated by the outflowing urine. The cystotomy wound in the left side of the bladder cannot be seen.

December 1, 1902. Patient in perfect health; urine normal.

CASE VI.—*Calculus impacted in Juxtavesical Portion of the Right Ureter. Demonstrated by Ureter Catheter and Radiograph. Ureterolithotomy. Suture. Cure.*

W. W. M., male, aged twenty-five years, admitted August 28, 1902. Complaint, "stone in right kidney." Family and past histories negative. No typhoid.

Present illness. Five years ago the patient was taken with a severe pain in the right side beneath the ribs, which lasted for six hours, and required morphine. One week later a second attack similar to the first came on, and again, after a week's intermission, the third attack. In all three the pain remained localized to the right side and back, and was not associated with hæmaturia or vesical irritability.

In December, 1900, after a respite of three years, he had an attack of pain which began in the right testicle, but soon travelled from there up to the kidney. After that four similar attacks occurred, about one month apart, the last being associated with hæmaturia, and followed by the passage of a small calculus. He was then free from pain until September, 1901, since which time he has had attacks at intervals of one to three weeks up to the present time. "The pain always begins in the right testicle and ends in the kidney." He has not passed a second calculus; there has been no urinary disturbance, no blood. Between attacks he has felt well, with the exception of a dull pain which is located deep down in the pelvis ("in the region of the bladder"), and is sometimes more severe after micturition. He has had no pain in the end of the penis.

Examination.—The patient is pale and extremely neurotic. Chest and abdomen are negative. Palpation of the abdomen is difficult, but there is no tenderness over the kidney or along the ureter. Rectal examination reveals nothing abnormal. Urine, clear, acid, 1020. No albumen, no sugar; a few shreds are present which are found to be composed of pus-cells; no bacteria present.

Cystoscopic examination with the plain Nitze instrument

showed a normal bladder. The ureters were both functionating, the fluid coming from each clear, and nothing present to indicate disease higher up on either side. Casper's catheter cystoscope was then introduced and the right ureter catheterized. After the catheter had passed upward for a distance of about four centimetres an impassable obstruction was encountered. Although considerable force was used, the catheter would proceed no farther, but always doubled on itself. To our surprise, however, we found that urine was flowing intermittently from the catheter, so that it was not withdrawn, but held carefully in place until a quantity sufficient for examination was obtained.

Urinalysis of this specimen showed much less urea than that of the voided urine. There was no pus present, but numerous pear-shaped epithelial cells were seen. The diagnosis of calculus of the juxtavesical ureter was made, and the patient was sent to Dr. C. Deetjen for X-ray photographs.

Radiographs.—Several radiographs were obtained. These showed nothing in the region of the kidney, but on the right side of the pelvis, corresponding to a point in the ureter about two centimetres above the bladder, a small oblong shadow was shown (about one by one and one-half centimetres in size). In order to determine accurately its distance above the bladder, I injected into the bladder eighty cubic centimetres of a heavy suspension of bismuth in water, and then had Dr. Deetjen take another photograph. This showed a large transverse oval shadow (the bladder), and just above it the smaller shadow (the calculus).

[This method should prove of value, in the absence of the cystoscope, to determine whether a calculus were situated in the bladder or above it.]

September 10. Urine voided in past twenty-four hours, 710 cubic centimetres. Total amount of urea, 18.5 grammes.

September 11. Total urine, 2200 cubic centimetres. Total urea, 20.5 grammes. The patient is in excellent condition. The urine is not infected. Operation advised (extraperitoneal ureterolithotomy) and agreed to.

Operation, September 12.—Extraperitoneal Ureterolithotomy. Dilatation of Ureteral Stricture. Closure of Ureter with Sutures.

An incision corresponding to the lower half of Israel's incision was made, the peritoneum stripped up from the iliac muscles and vessels, and the ureter found incorporated in the elevated

peritoneum. As in the other case (V), it did not stand out plainly visible on the posterior surface of the peritoneum, but instead was almost surrounded by the latter, to which it was so intimately adherent that only by palpation between the thumb and finger was the thickened tube felt and finally freed from its perineal bed. The ureter was one centimetre in diameter, its walls thickened and somewhat congested. After it was once discovered and freed it was an easy matter to follow it down its intrapelvic course, and there at a point one and one-half centimetres above its juncture with the posterior surface of the bladder a calculus was felt tightly impacted in its lumen and surrounded by considerable extra-ureteral scar tissue. The stone, which was about eight by fourteen millimetres in size, was dislodged with the finger from its incarceration, and "milked" upward until a point in the ureter above the pelvic brim was reached. Using the calculus as a bobbin, the sutures were put in before the ureter was opened, as in Case V.

After extraction of the calculus, small bougies, passed down the ureter, detected a stricture just below the site of the calculus. After considerable manipulation, a very small bougie was passed through the stricture, and followed by successively larger ones until the caliber was larger than normal. After exploring the higher ureter and renal pelvis with probes and finding no stone, the previously placed sutures were tied, thus tightly closing the ureteral wound.

The abdomen was closed as usual, a small drain leading to the ureteral incision having been provided.

The patient made a rapid recovery. The gauze drain was removed on the tenth day. There was no leakage of urine.

January, 1903. Patient has completely regained his strength and health. He is entirely free from the dull pain which he had before operation; urine normal.

CASE VII.—*Hæmaturia of Four Years' Duration. No Pain. Detection by Cystoscope of a Large Pedunculated Tumor of the Bladder, involving Region of the Right Ureter. Complete Extirpation by Suprapubic Cystotomy. Cure.*

J. D., aged sixty-five years; male. Admitted August 5, 1902. Complaint, "hæmaturia." Family history negative. Past history. Patient says he always had a tendency to bleed from small cuts more abundantly than other people. Had numerous and

prolonged attacks of epistaxis up to six years ago. A brother suffered similarly, but no other members of the family did. No previous history of urinary disturbance. No history of intravesical instrumentation, of traumatism, of calculus.

Present illness. About four years ago the patient first noticed that his urine contained blood. He had no abnormal symptoms, no pain, no urinary disturbance, and thought the blood came from exposure to cold. In a short time it disappeared, but the urine was cloudy, and has been so ever since. About one year ago red blood again appeared in his urine, but only lasted during one day, and he was otherwise symptomless. Since then he has had four similar attacks, the last one being ten days ago, when the amount of blood was greater than before. He thinks the two voidings must have contained together one pint of blood. With the exception of the cloudy urine and intermittent hæmaturia, he has noted nothing abnormal with the exception of a slight increase in the frequency of urination; the stream of urine is large, never any sudden stoppage, and he has no discomfort before, during, or after urination, except at times a slight burning in the urethra. He has often suffered with pain in the back, but there have been no symptoms indicating disease of either kidney.

The urine, as stated above, has been cloudy since the first attack of hæmaturia. During these the blood is usually well mixed with urine, but sometimes clots are passed. There is never any bleeding from the urethra between urinations. He has not had chills nor fevers, has passed no calculus, and has lost but ten pounds in weight. General health fairly good.

Examination.—The patient is well nourished, the mucous membranes of good color. Pulse 60 to the minute, vessel wall moderately thickened. Lungs normal. Heart, slight systolic murmur present at apex; other sounds clear. Abdomen negative, with exception of slight tenderness in the lower left quadrant of the umbilical region. Neither kidney palpable nor tender.

Urinalysis.—Slightly smoky, acid, 1021, albumen considerable, no sugar. Microscopically, many pus-cells; moderate number of red blood-corpuscles, no casts. Stained specimen of freshly voided urine shows numerous long and short bacilli.

Rectal examination. Prostate slightly enlarged and indurated, surface smooth, rectal mucosa not adherent.

Cystoscopic Examination.—A catheter passed easily and very

little residual urine was found, but hæmorrhage was at once produced, and after numerous injections the fluid still came away cloudy with blood. The cystoscopic examination was therefore unsatisfactory, but it was enough to determine that a large intravesical tumor was present, though the region of the bladder from which it sprang could not be made out. The patient was advised to submit to an exploratory suprapubic incision, but preferred to await developments.

Second Admission.—In February, 1902, the patient returned for operation. He reported that his urine had been free from blood during the Fall, but that the hæmaturia had returned later, and at times the loss of blood was considerable. Micturition had also become more frequent, but there was no difficulty in voiding. Recently the urine had been clear. On examination the patient was found to have lost weight, and was paler than before. The urine was much clearer than before, and contained no blood; pus-cells and bacteria present in moderate number. Prostate as before.

Cystoscopic Examination.—No hæmorrhage was produced by the catheter and a clear view was easily obtained. A large globular tumor was seen springing from the region of the right ureteral orifice by a broad pedicle. The surface of the tumor was rough, in places fissured, but not villous in type. No ulcerated areas were to be seen. The pedicle covered completely the orifice of the right ureter, preventing its detection. No urine was seen coming from that region. The adjacent bladder-wall looked healthy. The left ureter was functionating actively, and its orifice was normal in appearance.

Operation.—Suprapubic cystotomy. Excision of tumor. Partial closure of bladder and abdominal muscles. Drainage. Cure.

A long skin incision was made in the median line, the bladder opened, tumor located and found to be about five centimetres in diameter, globular in shape, with a short pedicle about two centimetres thick springing from the region about the right ureteral orifice.

In order to obtain good exposure, the peritoneum was stripped back from the vertex and upper portion of the posterior wall of the bladder. In accomplishing this, it was necessary to divide the urachus. [I have frequently employed this procedure and

found that it affords at once a splendid view of the interior of the bladder through the long incision which can be made after the perineum is stripped back. This procedure obviates entirely the necessity of transverse abdominal incision, or symphysiotomy, and other bone plastic methods which have been advocated as necessary for adequate exposure of the interior of the bladder.]

With the abdominal retractors placed so as to include the bladder-wall on each side, the pedicle of the tumor was within easy reach, and a long curved clamp was placed across it. As this clamp happened not to be close enough to the bladder-wall, traction was made by means of it on the pedicle, thus elevating a portion of the bladder-wall with it, and a second clamp was slipped on beneath it. [By thus taking successively "lower holds," a clamp may be placed very high up at the base of the pedicle.]

Not wishing to ligate the pedicle on account of its relation to the ureter, we cut it with a Paquelin cautery, the blade of which was kept in close contact with the under surface of the pedicle clamp. When the division was complete, the bladder-wall at once retracted, showing a depressed raw area about two by three centimetres in size, in which the ureter opened, and in which two or three small bleeding arteries were seen, clamped and ligated with catgut. Complete hæmostasis was thus obtained. The remainder of the operation consisted in closing the bladder and the abdomen (partially) with catgut, and providing intravesical gauze and tube drainage.

The patient stood the operation well. The convalescence was interrupted by a breaking down of the sutured muscular wound, but the patient ultimately made a good recovery. Cystoscopic examination, six months later, showed a practically normal bladder. The scar of operation could be hardly seen, and the orifice of the right ureter, which lay in it, was large and functionating well. The patient had regained his health completely. One year later he is still well.

BIBLIOGRAPHY.

[1] Poirier et Charpy. Traité d'Anatomie Humaine, Tome v, 1901.
[2] Morris. Surgical Diseases of the Kidney and Ureter, 1901.
[3] Glantenay. Chirurgie de l'urétére, 1895.
[4] Young. Bulletin of the Johns Hopkins Hospital, May, 1898.
[5] Fenger. American Text-Book of Genito-Urinary Diseases.
[6] Blumer. Bulletin of the Johns Hopkins Hospital, 1896.
[7] Young. Maryland Medical Journal, November, 1900.

[8] Caillé. American Journal of Medical Sciences, 1888, p. 481.
[9] Kelly. Journal of the American Medical Association, August 9, 1902.
[10] Fenwick. Edinburgh Medical Journal, 1898, p. 281.
[11] Regnier. Bulletin et Mém. de la Soc. de Chir. de Paris, March, 1893, p. 103.
[12] Schenck. Journal of American Medical Association, May 11, 1901, and Johns Hopkins Hospital Reports, Vol. x.
[13] Cabot. American Journal of American Sciences, 1892, Vol. c, p. 111.
[14] Israel. Chirurgische Klinik der Nierenkrankheiten, 1901.
[15] Stoeckel. Archiv für Gynäkologie, Band lxvii, Heft 1.
[16] Petersen. Medical News, August 11, 1900.
[17] Kelly. American Gynæcological and Obstetrical Journal, June, 1898.
[18] Morgan. ANNALS OF SURGERY, October, 1902.
[19] Kreissl. The Chicago Medical Recorder, March, 1899.
[20] Meyer. Medical News, September 22, 1900.
[21] Young. American Medicine, August 9, 1902, and Transactions of the Philadelphia County Medical Society, March 12, 1902.
[22] Kelly. Journal of the American Medical Association, August 16, 1902.

CONTRIBUTION TO THE SUBJECT OF PERINEAL PROSTATECTOMY.

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THE following case is reported partly because it offers some peculiar points in itself, and partly because it has some interest from the stand-point of the general surgeon in a phase of his work in regard to which the writings of specialists still give him diametrically opposed advice.

T. S., sixty-three years old, a boiler-maker. Denies venereal history. A moderate user of alcohol, and has been in excellent health until the onset of his prostatic trouble.

About five years ago he began to have some pain and difficulty in urination. This trouble was not severe at first, and he was able to empty his bladder fairly satisfactorily till four years ago, when he entered the Moses Taylor Hospital on another's service with what was apparently an attack of acute retention. His urine was drawn off by a catheter. He remained in the hospital at this time for a month, during which it was necessary to pass a catheter several times.

Since leaving the hospital, four years ago, he has never been able to void his urine naturally, and his story becomes that of an absolute catheter slave. In a short time he infected himself, as is shown by an attack marked by a painful swelling of the testicle which laid him up for three months.

The frequency of catheterization gradually increased, till lately it has had to be performed six or more times a day, and sometimes ten or twelve times at night. Pain and strangury became severe, and often, when the desire for the catheter came, he would be "doubled up with pain" before he could reach a suitable place. The urine became so thick that it would often block the catheter and necessitate its being removed and washed. For the past several months the urine has always contained a consider-

able amount of blood. The pain, the constant discomfort of catheter life, and the continued loss of sleep soon told severely on his health. He became emaciated, weakened, and in general reduced to a very pitiable condition, which brought him to the hospital ready to accept any risk rather than to continue unrelieved.

On admission to the Moses Taylor Hospital, September 6, 1902, examination showed a much emaciated man with marked senile changes. His face was drawn and haggard as the result of his years of suffering. Abdominal and thoracic viscera normal. Arteries thickened and tortuous. Prostate large, smooth, and hard. Its upper border cannot be reached by rectum. A soft rubber catheter passed after a little patience. It was not considered best to attempt any metallic instrumentation of the urethra.

After preliminary irrigations, the modified Alexander's operation was performed, September 13, with the assistance of Drs. Burns and Connell. Ether anæsthesia. A median incision was made over the pubes and the finger passed bluntly down the prevesical space till the prostate was reached and controlled. The bladder was not opened. A sound was passed into the bladder to identify the urethra in the deep tissues, and an inverted Y-shaped incision made in the perineum. On bluntly separating the tissues to expose the prostate, a ragged hole was torn in the rectum, much to the operator's disgust. This was ignored for the moment, and the enucleation of the prostate proceeded with. The right lobe was first shelled out, bringing with it a bar of tissue representing the middle lobe and a piece of the floor of the urethra. The left lobe was much higher up than the rest of the gland, but was reached and shelled out without difficulty. The greatest assistance was received all through the operation by the pressure from above.

Attention was then directed to the rent in the rectum. Although the operation had taken only a short time and was attended with very slight loss of blood, it was nevertheless desired to return the patient to bed as soon as possible on account of his previously weakened condition. An accurate suture of the rectal wall was therefore not attempted. A purse-string suture of chromic gut was placed around the tear and tied after the wall was inverted into the lumen of the bowel. A rubber tube surrounded by gauze was inserted into the anus and the rectal accident was not heard from after.

The bladder and operative field were thoroughly irrigated and a soft rubber catheter fixed in position in the perineal wound. The suprapubic wound was sewed tight and healed *per primam.*

There was very little reaction following the operation. The night after the operation was the "only comfortable one for years." The perineal tube was removed on the ninth day, and then sounds were passed every three days.

The opening in the urethra was somewhat large, as was also the cavity formed by the removal of the prostate and the sagging down of the tissues due to the Y incision. This gradually closed, and on the twenty-ninth day urine began to come through the penis. Progress continued very satisfactory till the forty-ninth day, when, during the passage of a sound, a stone was felt in the bladder. This had given no evidence of its presence since the operation.

The perineal sinus being open, it was still further dilated under ether, and the stone easily removed by this route without crushing. The calculus was smooth, egg-shaped, one inch in its longest diameter, and weighed 175 grains.

This second procedure naturally delayed the closure of the perineal sinus, which did not take place till the thirty-ninth day after the second operation. This period of convalescence is an unusually long one, but during it the patient was absolutely free from discomfort, and gained forty pounds in weight.

At the present time, four months after the first operation, the patient has absolute control of the bladder and urinates with perfect freedom. The bladder is at times completely emptied, and at times contains a small amount of residual urine. The amount apparently depends solely on whether the patient takes pains to empty his bladder thoroughly. He urinates now three or four times a day, sometimes sleeping straight through from 9 P.M. till 5 A.M., and sometimes getting up once during the night. The urine is only slightly cloudy. The bladder easily holds twelve to fourteen ounces of irrigating fluid.

The result seems to be a complete cure from the stand-point of both patient and surgeon.

There are three interesting features in the case:

1. The discovery of a stone seven weeks after operation. This was undoubtedly present at the time of operation and

escaped detection, notwithstanding the pressure from above and the insertion of instruments into the bladder several times during operation. This circumstance lends an argument to Alexander's original operation of opening the bladder. It is admitted that in this case the possibility of a stone as an additional factor was not kept in mind. If a thorough search had been made with this in view, the stone would probably have been found and could have been removed through the perineum intact or after crushing.

2. The tearing of the rectum. It is freely confessed that this is the operator's first case, and that tearing the rectum is wholly unnecessary, especially when the prostate is being exposed preparatory to shelling it out. The accident was instructive, however, as showing the good result obtainable in the rectum after a simple purse-string suture with inversion of the bowel wall. The procedure is comparable to the ordinary purse-string treatment of the appendix stump. It is the same general principle as the Kader gastrostomy which has been applied to the urinary bladder by Gibson, to the gall-bladder by Abbe, and to the cæcum by several surgeons. Senn has recently advocated the purse-string suture in the primary closure of stomach wounds, and it has doubtless been employed a number of times in rectal surgery.

3. The demonstration of the availability of the operation for the general surgeon. In a large degree the criterion of the usefulness and permanence of any operative procedure lies in the safety and benefit with which it can be applied by the general surgeon,—not by the inventor of the procedure, who himself may have had to perform it scores of times before it was perfected even in his hands. A surgeon on studying an operative procedure which he is called upon to do the first time, or at long intervals, can gain no aid from reading that one distinguished specialist has attacked an organ in one way hundreds of times with a certain percentage of cures, and that another, equally distinguished, has performed a like number of operations with like results but in an absolutely different way. What

the general surgeon wishes to know is what operations yield good results to others similarly situated. Percentages of mortality and cure, in order to aid him, must be compiled from a large number of cases from many surgeons. It is designedly therefore from the stand-point of a novice in this branch that the above report is offered.

RUPTURED CRUCIAL LIGAMENTS AND THEIR REPAIR BY OPERATION.[1]

BY A. W. MAYO ROBSON, F.R.C.S.,

OF LEEDS,

Consulting Surgeon to the General Infirmary at Leeds.

At first sight it would appear that an accident capable of rupturing the crucial ligaments of the knee would lead to complete disorganization of the joint; but the case that I am about to relate demonstrates not only that the crucial ligaments may be ruptured without serious damage to the joint as a whole, but that their repair by operation is both feasible and hopeful as to its ultimate result.

J. B., aged forty-one years, a miner, residing at Featherstone, was admitted to the General Infirmary at Leeds, November 4, 1895, on account of lameness from weakness and instability of the right knee, resulting from an accident when at work in a coal-pit thirty-six weeks before, when he was almost buried by a fall of earth, and sustained, besides the injury in question, a fracture of the left leg and of three ribs on the left side as well as internal injuries. After being in a neighboring hospital for six weeks he was made an out-patient, but returned in a fortnight on account of the right knee, which kept him in hospital for another six weeks, at the end of which time it was, he says, no better.

When admitted to the Leeds Infirmary, the knee was swollen but free from tenderness on manipulation. When the muscles were braced up, the bones were in good position, but as soon as the muscles relaxed, the tibia fell backward until stopped by the ligamentum patellæ. On manipulation the head of the tibia could be brought forward in front of the femur, and there was also very free lateral movement of the head of the tibia on the femur; some fluid in the joint could be felt and the patella floated. It

[1] Read at the Clinical Society of London, December, 1902.

was manifest that not only were all the ligaments relaxed, but that the crucial ligaments had been ruptured.

Operation, November 21. The joint was opened by an incision starting at the most prominent part of the internal condyle and passing downward and outward, crossing the ligamentum patellæ about the middle and extending upward to the prominence of the external condyle. On opening the joint the synovial membrane was found red and injected, and there was an excess of synovial fluid. Both crucial ligaments were found completely ruptured, being torn from their upper attachments, the ends being in a somewhat shreddy condition. They were stitched in position by means of catgut ligatures, the anterior being stitched to the synovial membrane and tissues on the inner side of the external condyle, and the posterior, which was too short and was split in order to lengthen it, was fixed by sutures to the synovial membrane and cartilage on the outer side of the inner condyle. The wound was then stitched up by means of buried catgut sutures and was closed superficially by interrupted silkworm-gut sutures.

Some pain followed the operation, and there was effusion into the joint, but on removing a stitch a little serous fluid escaped and relieved tension, the after progress being uneventful.

December 4. Stitches removed. Edges firmly healed; there was still considerable swelling in the neighborhood of the knee.

December 14. Plaster of Paris was applied, and he was allowed to get about on a Thomas' splint and to go home. The plaster was removed in a month, after which articular movement gradually returned under treatment by massage.

At my request, my house surgeon, Mr. W. Gough, visited him on October 24, 1901, and gave me the following report. The patient describes his leg as "perfectly strong." He walks well without a limp and can run. He works eight hours a day at his old employment of "getting" coal, and has never been off work a day on account of his knee since his discharge from the Infirmary. He has no pain in the knee except when he has overworked it, when he has a little aching over the inner side of the joint. There have been no attacks suggestive of a loose cartilage.

On inspection the scar of the old incision is seen. The joint looks fuller than the other and the outlines are rather blurred, the fossæ on either side of the patella being shallower than normal.

Measurement showed practically no difference in the circumference of the joints. There is no tenderness over the joint.

Movements. No abnormal mobility whatever is present. Extension to the straight line is perfectly free. Flexion is somewhat limited, but the knee can be flexed to just beyond a right angle quite freely, when it becomes fixed, and any attempt at further flexion causes pain over the outer side of the joint. On flexion and extension fine creaking is felt in the joint. The patient says the joint is more liable to pain him in cold, damp weather.

Remarks.—As a rule, I do not care for reporting a single example of any disease or injury, but having waited seven years without another case of ruptured crucial ligaments coming under my observation, I think the time has come for the publication of this one, especially as I am able to give a report of the condition so long after operation. A search through surgical literature has not rewarded me in discovering any other case in which these deeply placed and strong ligaments have been repaired; this therefore will, I trust, be a sufficient excuse for my contribution, as it clearly demonstrates the hopefulness of operation in so serious an injury.

Since reporting the above case I find another case was operated on August 5, 1898; the woman was shown at the Clinical Society February 23, 1900, the result being quite satisfactory.

[Mr. William H. Battle, in the British Medical Journal of December 13, 1902, refers to Vol. xxxiii of the Transactions of the Clinical Society of London, p. 232, where is described a suture of the crucial ligaments as a part of the procedures adopted in the treatment of an irreducible traumatic dislocation of the knee-joint in which an open section was made. This was done August 5, 1898. The resulut was good.—EDITOR.]

A CASE OF END-TO-END ANASTOMOSIS OF THE POPLITEAL ARTERY FOR GUNSHOT INJURY.[1]

BY ALEXANDER HUGH FERGUSON, M.D., C.M.,

OF CHICAGO,

Professor of Clinical Surgery, College of Physicians and Surgeons of Chicago; Professor of Surgery, Post-Graduate Medical School of Chicago; Surgeon-in-Chief of the Chicago Hospital.

At midnight of October 20, 1902, Mr. E. R. W., aged thirty-eight years, was received into the Chicago Hospital, having been shot in each thigh four hours previously. A temporary antiseptic dressing had already been applied on both wounds.

Examination after admission showed:

(A) *Right Limb.*—1. Bullet wound in thigh, two and one-half inches above the patella, to the inner side from which wound there was slight oozing of blood.

2. The whole limb was obviously swollen. It measured three and one-half inches more in circumference above the patella than it did on the opposite side, and from one to two and one-half inches more around the calf and thigh. The swelling was constantly increasing.

3. Pallor of the foot was observed, but the color around the knee was darker than normal, around which the superficial veins were engorged, and evidently the deep veins were compressed by the extravasated blood.

4. Loss of function. The limb as a whole could not be used.

5. Loss of sensation and motion of the foot, and half-way up the leg was marked. He could not feel what parts were being touched or pricked, and he had no power to move his foot and leg.

6. The foot and leg felt cold, but he complained of their being hot and numb. The whole surface of the limb was not as warm as its fellow.

7. Pressure on any part of the calf, knee, and thigh caused him to complain of pain. It hurt him to have the limb moved.

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[1] Read before the Western Surgical and Gynæcological Association, December, 1902.

8. Diffuse pulsation in the popliteal space could be seen and felt; it extended up and down as well as around the knee.

9. A systolic bruit was heard behind the knee and a thrill was felt.

(B) *Left Limb.*—A bullet wound was situated in front of the upper third of the thigh, but gave no inconvenience or special injury to the limb other than the penetration of the quadriceps extensor muscle.

(C) *Constitutional Condition.*—Shock was quite marked; he was weak, pale, and anxious looking. His pulse was 132 per minute, small and weak. His temperature was slightly subnormal, 98° F., and respirations normal. He was quite thirsty and his voice was weak and husky. He felt nauseated, but had not vomited.

Operation.—The bullet track on the left side was cut out for about four inches downward towards the knee, disinfected with carbolic acid, 95 per cent., and that neutralized with alcohol, and then the wound packed with iodoform gauze. The ball was not then found. In the injured right lower extremity the track of the ball was cut out through the soft parts down to the femur, which was found to have been penetrated at its inner edge about two inches above the patella. A plug of gauze was packed firmly into this wound to prevent hæmorrhage. An elastic tourniquet was secured around the thigh well up so as to prevent arterial hæmorrhage. A long incision, over the course of the popliteal artery, was made, which exposed its entire length. A large quantity of liquid and coagulated blood was removed from the popliteal space and from the cellular planes up and down the limb, with the fingers, and by free flushing with saline solution at the temperature of 115° F. It seemed to me important to wash out all the extravasated blood possible in order that the hinderance to the circulation might be minimized. A flattened bullet of lead was found immediately behind the injured artery, which had not penetrated the popliteal fascia. The artery was completely severed at the junction of the middle and upper third, except a few shreds of the outer coat next the vein. Upon relaxing the rubber band, blood spurted from the proximal end of the injured artery. I tied strips of gauze around the artery, one above and the other below the injury, for temporary hæmostasis. The tourniquet was then removed. The lacerated ends,

about an inch altogether, were removed. The caliber of the proximal end of the vessel was free and open, while that of the distal was occluded with a small blood-clot, which was readily squeezed out, and which shows that there was no collateral circulation. An anastomosis by the invagination method was then carried out. The upper end was introduced into the lower a distance of a quarter of an inch and held there by four retention sutures of fine silk, and the free edge of the lower end sewed around the upper with a fine continuous suture of the same material. The temporary ligatures of gauze were then removed and the blood allowed to enter the limb. Pulsation at the ankle was restored at once, the extreme pallor of the foot disappeared, and it became warm. While restoring the continuity of the artery, the leg was flexed at a right angle. A broad flap over an inch wide from the semimembranosus muscle was lapped around the artery at the seat of union. The branches of the artery destroyed were the superior internal and external articular. The popliteal vein was intact, but in clearing out blood-clots opposite the junction of the middle and lower third, two small branches were injured and tied close to the main vein. The popliteal nerve was not injured. The wound was closed with silkworm-gut sutures except at its upper and lower angles, where gauze drainage was left. The bullet wound was also drained with gauze. A mammoth dressing was applied and the limb fixed at an obtuse angle with a plaster-of-Paris bandage, the foot being left exposed.

While on the operating table, hypodermoclysis of normal salt solution of 700 cubic centimetres, at a temperature of 115° F., and strychnine, one-thirtieth of a grain, were given. When the operation was over, his pulse was 112, temperature 100.6° F., and respirations, 20.

After-Treatment and Progress.—During the rest of the night he rested well. Strychnine, one-thirtieth of a grain, every hour was given for four doses, then every two hours for twenty-four hours. Inasmuch as there was no nausea or vomiting, he was allowed to swallow as much hot water as he desired. The next morning sensation was found to have returned in the toes and foot; the skin was normal in color and it felt warm. The urine passed during the first twelve hours after the operation was twelve ounces; it contained albumen, blood, epithelia, pus,

casts both hyaline and granular; it was acid in reaction and had a specific gravity of 1030. The second day his temperature was 100° F., pulse 118, and respirations 20, and he rested comfortably. The strychnine, one-thirtieth of a grain, was given every three or four hours hypodermically and liquids *ad libitum* by the mouth.

Noteworthy Clinical Changes.—Just forty-one hours after the operation, a sudden, severe shooting pain was felt in the calf. Up to this time the foot appeared normal. It suddenly changed in color, and sensation disappeared. When I saw him five hours afterwards, he was still complaining of pain in the calf, ankle, and foot. The foot felt warmer than normal, was slightly swollen, superficial veins engorged, sensation lost, and its color changed, and appeared by electric light to be of a darker hue. The pulsation of the anterior tibial artery at the ankle was gone.

Hot fomentations were applied to the foot and ankle. The next morning, at nine o'clock of the third day after the anastomosis, the foot was shrivelled, pale, bloodless, and senseless. The arterial supply of blood to the periphery was evidently cut off, and within the next three days dry gangrene ensued, with a slight increase of temperature, but the pulse improved, being only 90. The first dressing of the wound was changed on the fifth day through a window in the plaster case, part of the gauze was removed. On the ninth day all gauze drainage was withdrawn, the wound cleansed, and a small packing of iodoform gauze substituted. By this time (ninth day) a clear line of demarcation between the living and dead parts was pronounced. The toes, a strip down the sole of the foot, and a patch on the heel about the size of a silver dollar, as well as several spots on the outside of the foot and ankle, were dead.

First Amputation.—Inasmuch as no untoward constitutional symptoms arose, the patient getting stronger, and the wounds undergoing a natural process of repair by granulation, amputation was deferred until the thirty-first day after the injury. During this time nature was performing an aseptic separation while strict antiseptic precautions were carried out. Then the toes, along with the ends of the metatarsal bones, a broad strip along the sole, and the necrosed patch on the heel were removed by me. With the hope of saving as much of the foot as possible, the sole of the foot was left uncovered by skin. The foot was

surgically treated for four weeks thereafter, but the sole did not granulate over, but, instead, all the soft structures down to the bones necrosed, and another operation was advised.

Second Amputation.—On the fifty-first day after the injury the second amputation was undertaken, and the foot removed at the mediotarsal joint. At this time the bullet from the left thigh was removed. It was situated four inches above the patella beneath the quadriceps extensor.

March 16, 1903.—The patient is now well. He is using his limb and attending to his business. He returned to the hospital on February 12 complaining of inability to straighten his limb, owing to the cord-like condition of the scar in the popliteal space. I removed the entire scar tissue, and took occasion to examine the artery. *I was delighted to see and feel pulsation above and below as well as at the seat of the anastomosis.* This is the best evidence of the success of the operation.

In looking over the literature, I have failed to find the report of a case of anastomosis of the popliteal artery.

THE SUCCESSFUL REMOVAL OF A LARGE ENCHONDROMA OF THE CHEST WALL, INVOLVING THE DIAPHRAGM.

BY J. C. REEVE, JR., M.D.,

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Surgeon to St. Elizabeth Hospital.

THIS case was not thought to be in any way unusual until similar cases of removal of the chest wall for tumor were sought. The growth occupied the lower lateral chest wall in a man of over sixty-six. It had been growing gradually for eleven years, more rapidly of late, and now itself measured thirty-three inches in circumference, and sagged over the pelvis so much that it seemed to spring from that point. When the patient was dressed he seemed to carry a large and heavy basket under his clothes, such was the inclination of his trunk. Lobulated and of stony hardness, the skin in places thin, large superficial veins, no enlarged glands.

In operating, large skin flaps were made from the sides of the tumor, and the ribs partly divided, when it was discovered that fully a third of the growth was inside the pleural cavity and attached to the diaphragm. An opening in the chest wall the size of two hands was made, the whole pleural cavity being exposed to view, including the pulsating pericardial sac. Retraction of the lung was complete. Considerable hæmorrhage had naturally been expected, but when the mass was finally detached only three small muscular twigs required tying. The remains of the diaphragm and some fascia were brought together in one layer and the skin in another, and all spaces, including the pleural cavity, drained with gauze. The only reactions were occasional attacks of dyspnœa with rapid pulse, and on the third day a single rise of temperature for an hour to 103° F. The photograph shows that after a year and a half neither hernia nor depression results. After two years there has been no recurrence. The photograph of the tumor shows it much contracted by long maceration in formalin, after the loss of its softened contents and its skin flaps, and with three ribs extending through it. Its weight was fifteen pounds, and in various places inside it was gelatinous,

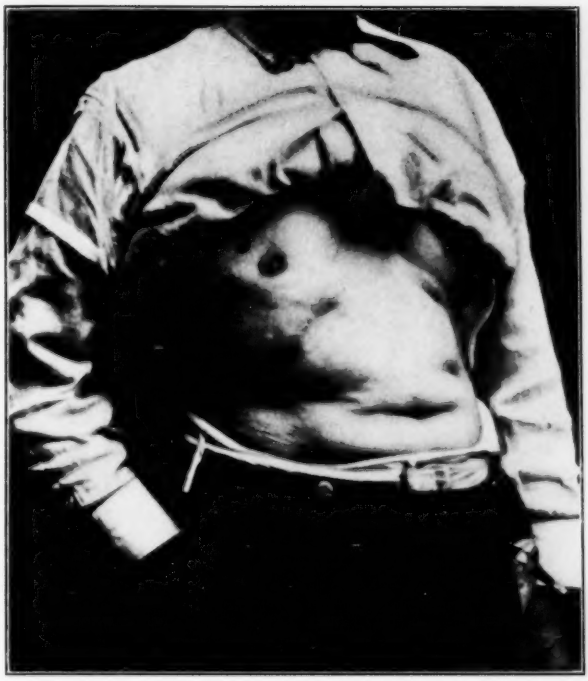

FIG. 1.—Cicatrix left after removal of tumor.

FIG. 2.—Tumor after removal.

presumably from pressure necrosis. Neither these portions nor those of stony cartilage would guide a microscopist to its original nature. Probably an enchondroma with more or less sarcomatous admixture.

The factors here fall partly within and partly without the rules given by Jacobson to guide us in choosing such cases for operation. The tumor should be nodulated and well-defined, of slow growth, moderate size, involving not more than parts of four ribs, surface hard, the skin not infiltrated, no enlarged glands, and no dulness in the neighborhood of the growth (the last excluding secondary deposits in the lung rather than an intrapleural extension of the tumor). Considerable search shows the following successful case by Zarübin, of Kharkov, to be the nearest approach to the one above described.

The patient was a young Cossack, and the tumor measured eight and one-half by seven and one-half inches, was larger than the head, and weighed six pounds. The opening in the chest wall was six and three-quarters by six and a half inches. There were some pleural adhesions; otherwise the operation and after-course were quite similar. Zarübin reports ten other cases, six of which were successful.

HEPATIC SYPHILIS FROM A SURGICAL STANDPOINT.[1]

BY CHARLES GREENE CUMSTON, M.D.,

OF BOSTON, MASSACHUSETTS.

In October, 1900, in an address delivered before the Cheshire County Medical Society, it was endeavored to point out the necessity of a closer study by observation and exploratory incision of cases of syphilis of the abdominal viscera, and in that address several instances were reported.

The first case of hepatic syphilis that it has been our lot to operate upon was a gentleman, forty-one years of age, married, and the father of four children, the first two having died at birth, the other two always having been in good health. The antecedents, both personal and hereditary, of the patient were without interest, and he denied ever having contracted syphilis. He was not an alcoholic. About three months before the patient came under observation he had become suddenly jaundiced, and soon after he complained of pain in the right hypochondriac region as well as in the right shoulder-blade. Palpation showed that the border of the liver extended about four fingers'-breadth below the costal margin and extended towards the median line. A slight amount of ascites was present, and the patient had lost some ten pounds in weight since the commencement of his illness. Œdema of the lower extremities was wanting, and there was entire absence of any history pointing to melæna or hæmatemesis. A detailed examination of the other abdominal and thoracic viscera was negative, and there was complete absence of enlarged lymphatic glands in the various points where they are to be found. A diagnosis of carcinoma of the liver or gall-bladder was made, and an exploratory incision advised.

[1] An address delivered at the annual meeting of the Manchester Medical Society, February 18, 1903.

An incision was made in the semilunar line over the growth, and the enlarged liver was exposed after numerous tough adhesions with the parietal peritoneum had been broken down. The liver felt hard, and two nodules, the size of English walnuts, projected from the anterior surface of the right lobe near its border; their contour was regular and their surface somewhat nodular; in color they were light yellow. There was no evidence of carcinoma, so that an incision was carried across both nodules and a large amount of cheesy material scooped out, leaving two rather clean-cut cuplike cavities in the liver. The cavities were packed with gauze and the abdominal wound closed excepting at the upper angle, which gave exit to the drains. These were removed in four days and the abdominal wound rapidly closed.

Iodide of potassium, at the dose of four grammes daily, was administered, and continued for three months and a half. The jaundice completely disappeared within five weeks of treatment with the iodide, and at the end of three months the liver had resumed its normal size. The patient was under our care over a period of two years, and has remained perfectly well.

Since observing the above case five years ago, my attention has been carefully directed towards syphilitic manifestations in the liver, and two other instances have occurred, the histories of which will be shortly given. On account of the extreme interest in hepatic syphilis from the surgeon's stand-point, I have gone over the literature of the subject with some attention, and have been able to collect a number of instances in which the abdomen was opened after a mistaken or correct diagnosis had been made, and these cases will be briefly referred to; but for a moment I would like to direct attention to a few remarks on the pathology and diagnosis of the late manifestations of this potent virus in the liver.

What strikes one's attention first of all is that gummata of the liver produce the same symptoms as do other neoplasms of this viscus, both functional and physical. Mauriac has said in his excellent writings that tertiary syphilis of the liver, in the gummatous, sclerous, or sclerogummatous forms, slowly and

obscurely progresses, and only reveals its presence when the organ is seriously affected by the process. Now, as a matter of fact, the functional symptoms are often only slightly pronounced. Pain, loss of appetite, diarrhœa, and, later on, ascites with changes in the urine are the clinical phenomena which are nearly always present during the evolution of gummata of the liver, but each of these vary greatly in intensity in one case to another. Usually the patient will complain of a sensation of weight in the region of the liver rather than a real pain. There are periods of increase and disappearance, the first of these usually being accompanied with a slight rise of temperature. In some rare instances, however, pain has been complained of for several months.

Besides the cases in which pain is only of secondary consideration, there are others which are certainly far from infrequent, in which the syphilitic neoplasm is accompanied by an adhesive perihepatitis, in which case the pain will be extremely severe, and is not only complained of in the region of the liver, but in the thorax and back as well. Respiration becomes extremely painful and difficult.

In many cases the patients will complain of weakness of the limbs, loss of strength, and nervous depression. This condition is usually more marked towards night; and, although it is not precisely pathognomonic, it should be always taken into serious consideration when making the diagnosis of a syphilitic lesion. Simon has pointed out that towards night there is a tendency to chills and a marked sensibility to cold, although the patient's skin may be warm and moist, while the pulse is fuller and more frequent.

In the beginning of the process the digestive disturbances are slight, usually amounting to an irregularity in the appetite and some dyspepsia; but as the neoplasm increases in size this condition becomes more marked, and may arrive at such a point that anorexia is complete and the patient shows a decided distaste for all kinds of food. Vomiting may occur, which, according to Lacombe, disappears at the end of the affection, diarrhœa sometimes taking its place, which may be occasionally

accompanied by a melæna. In other cases constipation with intestinal distention is observed.

Ascites appears to be a rather constant symptom, so much so that so great an authority as Fournier says that he has never seen it absent, but Trinkler and others have found it totally absent. Often it is considerable in amount, and the liquid reappears very rapidly, following paracentesis. The ascites may give rise to pseudomembranous deposits on the peritoneum, especially that covering the liver. When the neoplasm arises near the biliary tract, by compression it may produce a marked jaundice, whose evolution will, from the nature of the process, be slow and most persistent. According to many writers on the subject, it causes only slight disturbances. The urine may contain albumen, because renal lesions are often present at the same time.

Among the objective symptoms, the first which usually draws the surgeon's attention is an increase in the size of the region of the liver and the upper part of the abdomen. This is not only due to the size of the growth, but also in some cases to the ascites present. The abdomen will be found to have developed more particularly in its upper part, especially in the right hypochondrium and epigastrium; occasionally it is enlarged in the left hypochondrium. The tumefaction may extend more or less to the umbilical region, and this is more frequently the case when the left lobe of the liver is the seat of the trouble. Oftentimes a peripheral circulation more or less marked is observed in the abdominal wall. If the region of the liver be carefully examined, the patient taking deep inspirations, the tumor may often be seen to follow the movements of the lungs, which are imparted to the liver by means of the diaphragm; but if the neoplasm has contracted adhesions with the surrounding viscera, its mobility will naturally be uninfluenced by respiration. When the tumor has attained a certain size, palpation will often show its size, seat, external shape, its mobility and consistency; but it should be pointed out that the site of the neoplasm varies greatly, according to the lobe involved. Thus, a syphilitic neoplasm of the left lobe may occupy

the epigastrium, and extend well down even to the region of the umbilicus, but usually palpation will demonstrate its connection with the liver.

By palpation the presence of adhesions of the growth with the surrounding viscera may be demonstrated, but the information obtained by palpation may occasionally lead one in error, because a solid neoplasm, on account of its structure, may give rise to the phenomena of fluctuation, and thus may be mistaken for liquid growths. The degree of mobility of neoplasms of the liver is most varied, but usually it is more marked transversely. Sometimes, however, the tumor may be moved up and down, but it is only infrequently that it can be pushed downward.

Percussion will give dulness, which usually extends directly from the growth to the liver, but in some instances a line of sonority was present between the neoplasm and the liver.

From what has been seen, it is evident that the various symptoms are nearly all common to the various neoplasms arising from the liver, and in making a diagnosis of a gumma the past history of the case is the only one that can lead us to the correct conclusion.

Syphilis of the liver is either acquired or hereditary, and it is only during the late tertiary period that gummata make their appearance. They usually do not arise in the liver until five years have elapsed since the date of infection, and more commonly it is from ten to fifteen or even twenty years afterwards that they manifest themselves. They appear in that period of the disease when the patients are afflicted by circumscribed gummata of the skin, exostoses, and ulcerations of the pharynx. In adults the typical tertiary lesion of the liver is the sclerogummatous form. The deep depressions in the anterior border of the organ and the bands of cicatricial tissue which cover and penetrate the hepatic tissue are characteristic of syphilis. Virchow has said that the largest depressions are found in the neighborhood of the suspensory ligament, and that this bossed condition is always more marked on the convex

aspect of the organ. Between these depressions large milky patches are often seen, which signify that inflammation of Glisson's capsule has been present, and especially the white cicatrices from which fibrous tracts start off.

Gummata vary in size from a split pea to a walnut, their form being either quite round or irregular. They may be isolated from each other in the midst of the hepatic parenchyma, or when numerous their arrangement is most variable.

If a section of the liver is made it will be found extremely hard, and the parenchyma of a yellowish hue. Disseminated throughout the organ, more perhaps in its centre than at its surface, yellowish or whitish neoplasms, which occasionally are either of a light or a dark red color, are found.

The gummata are composed of a homogeneous peripheral part, which appears itself to be limited externally by a fibrous shell. Towards the centre caseation will be found to have taken place. Gummata may undergo calcification and become encysted, or they may disappear by fatty metamorphosis or by absorption, in which case they leave star-shaped cicatrices, which have been so well described by Lancereaux.

Microscopically, the most marked lesion is found in the connective tissue which has undergone a hyperplasia, not only of the interlobular connective tissue itself, but everywhere where this tissue is present, both in the interior of the lobules as well as at their periphery, so that there is at the same time a perilobular and an intralobular cirrhosis. These changes show themselves under the form of fibrous bands which radiate in every direction, compressing the lobules, which ultimately give rise to fatty or amyloid degeneration of the cells. By this same compression the small hepatic and portal vessels become compressed, giving rise to a mechanical hinderance to the circulation, which in its turn produces ascites. The lumen of the vessels may even be completely obliterated, on account of the development of cicatricial tissue within their walls. The larger vessels may also become involved in the process, and it has been pointed out by Verflassen that in advanced lesions

of the liver marked changes of the portal and cava veins will be found.

The large vessels, in point of fact, are compressed by the connective tissue, and in certain places their walls will be found to have almost completely disappeared. They are compressed laterally, their lumen being reduced to a small slit, while in other cases the lumen remains large and gaping. This explains why in some cases hæmorrhage during operation has been slight, while in others it has been so severe and difficult to control that the patients have died.

The biliary canals usually escape the process, but occasionally the smaller ones become obliterated by compression from a gumma. Both Virchow and Lancereaux have recorded cases of compression of the larger trunks, either by gummata or by lymph nodes, the compression having given rise to jaundice.

Microscopically, gummata vary according to whether they are of recent date or of long standing. The former, according to Cornil and Ranvier, are formed by small microscopical nodules whose centre has undergone an atrophy and a granular degeneration of the cells, while the round cells found in the periphery become confounded with the neighboring embryonal tissue. The large gummata are simply formed by a large number of these nodules.

In old gummata naked-eye inspection shows three concentric zones,—a central one which is yellow and softened; the middle is more resisting and elastic; while the external one consists of a fibrous shell. The central softened part contains small cell elements packed closely against each other and filled with fine granulations; they are undergoing a granulo-fatty degeneration. The elastic zone is composed of lacunæ limited by connective tissue and containing larger granulations, while the peripheral zone is composed of very tightly packed connective-tissue fibres imprisoning sclerotic vessels and round or flattened cells. In the large majority of cases an adhesive perihepatitis is present, binding the liver to the diaphragm and the surrounding viscera.

Amyloid disease of the liver is frequent during the progress of tertiary syphilis; the entire viscus becomes involved and is uniformly enlarged. It will be found very hard and smooth and frequently projects quite a distance below the costal border. It is accompanied with symptoms of amyloid disease in other viscera, such as the intestines and kidneys. The treatment is antisyphilitic.

The diagnosis of gummata of the liver is always a matter of extreme difficulty, and, even if the diagnosis of the other neoplasms of the liver appears to be practically certain, it is far from easy to assert the nature of the growth.

As to the differential diagnosis, syphilitic neoplasms of the liver may simulate very closely all the various affections to which this organ is heir. Lancereaux has published a case in which a diagnosis of tubercular peritonitis was first made, and then was changed to that of carcinoma of the liver, and the exact diagnosis was only made after an exostosis of the skull made its appearance. The rapidity in the development of gummata of the liver oftentimes simulates serious carcinomatous disease.

Occasionally a large softened gumma might be taken for an hydatid cyst, and should it be accompanied with fever and symptoms of suppuration, it is easy to understand how difficult the diagnosis would be between a gumma and abscess of the liver. In Lilienthal's case, in which a suppurating gumma of the liver was present, the diagnosis wavered between an affection of the liver and a suppurating cholecystitis.

Tuberculosis of the liver need never enter into serious consideration, because in adults it is extremely rare. It is occasionally met with in children in the form of miliary tubercles, or as small yellowish tumors the size of a pea, which never assume such dimensions as to give rise to a true tumor.

The diagnosis of hydatid cyst might be considered, but the absence of a fluctuating mass, or a smooth, round tumor, would render the diagnosis doubtful until an exploratory aspiration showed an absence of fluid.

An hepatic gumma may be easily mistaken for a carcinoma

of the liver, but it should be recalled to mind that primary malignant disease of this organ is rare, and on the other hand, in cases where the malignant disease invades the liver as a secondary manifestation, the primary growth will be found in some other organ. Besides, the progress of carcinoma is much more rapid than that of gummata, and cachexia is more marked. The advanced stages of syphilitic disease of the liver are difficult to differentiate from carcinoma, especially in subjects well along in years, and when there is much nodulation and general cachexia. It has been asserted that malignant disease is more frequently localized to either the right or left lobe of the organ, at least in the early stages, while syphilis involves both lobes at once; but this, as will be seen by some of the cases reported, seems to be an entirely erroneous conclusion. On the other hand, little help can be derived from this statement, because it is most difficult or even quite impossible to ascertain whether one or both lobes are involved; but I would point out that the presence of an enlarged spleen would be in favor of syphilis, since it is common in this disease and rare in carcinoma.

The jaundice of late syphilis due to hepatic complications usually gives the patient the appearance of strongly marked cachexia; he is either thin, weak, livid, and shrunken, or bloated and flabby. The color of the skin is a deep yellowish brown, as distinguished from the decidedly lighter yellow hue of the jaundice due to functional disturbances or the bile secretion. Hyde and Montgomery observe that there is usually severe headache and often albuminuria, but this seems to be wanting in most of the cases that have been collected in this paper.

We would also mention the differential diagnosis with ulcer of the duodenum, because a few years ago such a case came under our observation, and, as it has some interest pertaining to this subject, we will briefly relate it.

The patient, a well-built, muscular man, of about forty years of age, had complained for a number of months of more or less

severe pain in the region of the gall-bladder. He had been slightly jaundiced for several months. The tongue was furred, the temperature normal, and the pulse averaged about 80. Examination of the abdomen revealed a large, somewhat nodulated mass in the region of the gall-bladder, the border of the liver extending about three fingers'-breadth below the costal margin. A diagnosis of tumor of the liver or some affection of the biliary apparatus was made, and an exploratory laparotomy was done. When the abdomen was opened, a small amount of ascitic fluid escaped. The enlarged liver was seen in the wound, but the region of the gall-bladder, where the tumor had been felt, presented a mass of adhesions of considerable strength. These were broken through, the gall-bladder was found normal in size, and contained no calculi, so a diagnosis of ulcer of the duodenum was made. Owing to the great amount of adhesions present, it was decided not to interfere farther, and the abdomen was closed.

A physician, who had treated the patient some years previously and who was present at the operation, informed us that he had formerly treated the patient for syphilis, and from this knowledge obtained the patient was immediately placed upon large doses of iodide of potassium, which completed the cure of all the symptoms within three months, the tumor disappearing, and the patient returning to perfect health. Over two years after the operation he was still perfectly well.

The only means of absolute value in helping one to assume the diagnosis of gummata of the liver is a previous history of syphilis in the patient; but one should not only look for traces of acquired syphilis, but for those of the hereditary form as well. Fournier especially insists on the point that gummata of the liver occur as frequently in hereditary syphilis as in the acquired form.

We will now report the histories of two more cases of hepatic gummata which have been under our care, making three in all.

The first was a married woman, thirty-nine years of age, who had complained for some time of a dull pain in the right hypochondriac region, and occasional nausea. The patient had in her early married life three miscarriages, but later on had given

birth to two children, who apparently were in perfect health. The patient was somewhat jaundiced at our first examination; the tongue was furred, pulse 76, temperature and respiration normal.

Blood examination gave a slight leucocytosis. Examination of the thoracic viscera was negative, and no enlarged lymph nodes could be detected in the axilla, groin, or supraclavicular region. Palpation of the abdomen revealed a somewhat nodular tumor lying in the epigastric region and nearly reaching to the middle line, and extended about five fingers'-breadth below the tip of the sternum. Both liver and tumor moved with the respiration, and by percussion the growth appeared to be directly connected with the liver.

From the history of the case, the tumor was considered as probably syphilitic in nature, but, as there was some doubt as to the possibility of the disease being malignant, an exploratory incision was advised and accepted.

Several days later the abdomen was opened in the right semilunar line. A small amount of ascitic fluid escaped. The tumor was composed of the left lobe, which was studded with numerous tumors varying in size from an almond to a walnut. They were more or less circular in shape. A small superficial one situated near the border of the organ was excised for microscopical examination and the abdomen closed.

As the growth proved microscopically to be a typical gumma, the patient was immediately placed on inunctions of mercurial ointment and iodide of potassium at the dose of four grammes daily. Under this treatment her recovery was remarkably rapid, so that in less than four months all traces of the tumor had disappeared and symptomatically she was well. This case was followed for over three years after the operation, and has remained in good health ever since.

Our third and last case was a male forty-nine years old, a merchant, who had always led a rather irregular life. He was unmarried. He had had three attacks of gonorrhœa, but denied ever having contracted syphilis. For the last year and a half he had been losing weight, so that from 190 pounds he had dropped to 167. He was a well-built man, although he had become quite anæmic. At about the time he began to lose flesh he had noticed a fulness in the upper part of his abdomen, but had paid little attention to it, as it gave rise to no pain. He had

never had, as far as could be ascertained, any serious sickness excepting pneumonia at the age of twenty.

When first coming under observation in September, 1901, the fulness in the upper part of the abdomen had begun to produce a certain amount of hinderance to the respiration, and added to this discomfort the patient was complaining of digestive disturbances, consisting in anorexia, slight nausea, and eructations of gas. The temperature was normal and the pulse 82.

On examination, the heart and lungs were found to be normal, the urine containing a trace of albumen, but no casts.

Percussion showed that the liver-dulness extended to about three fingers'-breadth below the costal border, and from there towards the epigastrium and downward to within three fingers'-breadth of the umbilicus. By palpation an ill-defined mass could be made out in this region; its surface was irregular, and it was somewhat painful when pressure was used. It appeared to be connected with the liver, and was fairly movable transversely, but it could not be pushed either upward or downward.

From the history of the case, and from the condition found by examination, a malignant tumor was suspected and an exploratory operation advised and accepted.

An incision was carried along the external border of the right rectus muscle, and when the abdomen was opened the tumor was found adherent to the peritoneum. By careful manipulation the adhesions were broken down, when it was found that the tumor sprang from the under surface of the left lobe of the liver, and was connected to the organ by a pedicle, the diameter of which might have been about the size of a quarter of a dollar. A chain ligature of celluloid thread was passed through the pedicle, which was then tied, and the tumor easily removed. There was little oozing from the stump, but it was thought more prudent to insert a small iodoform gauze wick, after which the abdomen was closed. The pedicle of the tumor was four centimetres long, while the growth itself was very much the size and shape of an orange.

Microscopical examination showed that we had removed a pedunculated gumma of the liver. Several similar cases have already been reported, and there is one that I know of by Mr. Mayo Robson, but, unfortunately, it has been impossible to find the reference to this case in the literature.

In the *Traité de Chirurgie,* edited by Duplay and Reclus, Segond in his article is decidedly against surgical interference in syphilitic growths of the liver. I cannot, however, agree on this point with my distinguished friend; but it is certainly proper that when once a diagnosis of syphilis of the liver has been made with any degree of certainty, an antisyphilitic treatment should be exhibited and persevered in for a considerable lapse of time. Mercury in the form of inunctions, and the iodide of potassium internally, should be given in sufficiently large doses in order to judge of their efficacy, and by sufficient doses we mean that one gramme of the ointment, and at least three to four grammes of the iodide should be taken daily. When this treatment remains unsuccessful, even if we are in the presence of a gummatous liver, it is because the gummata are so old and the tissues have become so changed that medical treatment is without avail, and under these circumstances the question of surgical interference may very properly be considered. It is hardly necessary to say that not all gummatous tumors of the liver which have resisted all treatment can be removed by operation, because, in order to be able to extirpate them, the tumor must form a single mass, and numerous deposits scattered here and there in the liver substance would render it impossible to remove them all. Besides this, the location of the tumor in an accessible point is necessary, that is to say, either in the left lobe or on the convexity of the right lobe; but even here this rule cannot always apply. Bastianelli was able to extirpate a gumma arising in the under surface of the liver, and Lauenstein removed one from Spiegel's lobe.

What is particularly essential is that the tumor be not profoundly situated in the hepatic parenchyma, because in this case its removal would necessitate such a destruction of the organ that the patient's life might be in danger. But in those cases where the gumma is only covered by a thin layer of parenchyma, resection is without danger and relatively an easy matter. In cases of pedunculated gumma the operation is fairly easy when the growth has sprung from the under surface of the liver, for little or no injury is done to the hepatic tissue, and con-

sequently with a good ligature there is practically no danger of hæmorrhage. The size of the tumor makes little difference regarding its removal, provided it is easily accessible. The presence of dense adhesions is a matter which can only be considered in each given case; but if the operation be carefully conducted, it would seem that, other than rendering it much more tedious, the presence of adhesions will not materially interfere with the removal of the growth in the large majority of cases.

In some cases a complete extirpation of the tumor will be found impossible, when, for example, it is more or less diffused, and sends off tracts of neoplastic tissue into the hepatic parenchyma.

To discuss the technique of removing tumors of the liver would carry me far beyond the intended limits of this address; as they are so well known, I shall leave them entirely aside, and in closing I would say that when an abdominal tumor is discovered in a given case, happy should be the patient if he has had syphilis.

CHRONIC INTERLOBULAR PANCREATITIS.

REPORT OF A CASE OF PANCREATIC CALCULI, WITH MULTIPLE CYSTS OF THE PANCREAS.

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THE patient, Mrs. K. S., thirty years old, first entered St. Luke's Hospital, March 22, 1902, under the care of Dr. Clarke J. Burnham, giving the following history:

Her mother and one sister had died of pulmonary tuberculosis. She herself had been delicate since childhood. Rheumatism at nine; miscarriage at seventeen; pneumonia at twenty; metritis and oophoritis at twenty-two. Previous to one year ago she had been a drinker of alcoholic stimulants; since then she has not touched liquor at all. Her present illness dates back nearly one year. For the first two or three months she complained of feeling badly,—troubled with nausea, indigestion, and general malaise. Then, nine months ago, she suffered from an attack of jaundice lasting about one week. After this she suffered some from indigestion. Five months ago she had an attack of severe, griping, paroxysmal pains in the epigastrium lasting for several days. One month afterwards she had a similar attack, but added to her epigastric pain she began to have a severe, dull, heavy pain in both lumbar regions. This was ushered in by a chill followed by fever, accompanied by frequent micturition; but very little urine was voided. From this time on she suffered from attacks about every two weeks. The pain left the epigastric area and centred in the lumbar regions, principally on the right side, and gradually extended down towards the pelvis. Patient had pain in the right shoulder all the time, increased during the attacks of pain below the diaphragm. For the last four months the stools have been clay colored at times. She has lost fifty pounds in weight during the last year. She has also suffered from hæmorrhoids for the past year, and on the day of admission to the hospital she passed

[1] Read before a meeting of the Academy of Medicine, San Francisco, February 24, 1903.

a large clot of blood while straining at stool. Anorexia has been present all the time. She has never noticed any blood in the urine, nor excessive amounts of urine after attacks of pain. No history of passing gall or renal calculi.

Examination on Admission.—Pulse, 80; respiration, 20; temperature, 98° F. Fairly well nourished, rather anæmic. Skin, sallow; conjunctivæ, slightly yellow; tongue, coated. Nothing unusual in lungs, heart, or thoracic wall.

Abdomen; Inspection.—Some fulness in right upper quadrant.

Palpation.—Right rectus very rigid. Two very painful points found on superficial and deep pressure,—one in the epigastrium just to the right of the median line opposite the sixth interspace, the other directly over the gall-bladder. The edge of the liver could be felt one inch below the costal margins, hard and slightly tender. Extending from the tenth rib towards the umbilicus, beneath a very tender area, a decided sense of resistance was felt as of a mass, although, on account of the muscular rigidity and tenderness, it was not possible to diagnose a tumor from palpation alone. Palpation of the kidneys and pelvic viscera was negative.

Percussion.—Liver-dulness enlarged downward about one inch below free border on right side. Dulness continuous with the liver-dulness extended across the epigastrium to the left side opposite the sixth interspace over the painful epigastric area. This dulness also extended from the gall-bladder region, triangular-shaped, with the apex about one and one-half inches from the umbilicus. Elsewhere the abdomen was moderately tympanitic.

Auscultation developed nothing new.

Urine.—Amber, acid, 1018, no sugar; slight traces of albumen and bile. Microscopically, it showed calcium oxalate crystals, pus-cells, granular casts, few red cells.

Stools.—No free fat found. They were clay colored, however.

Blood.—Hæmoglobin, 75 per cent.; reds, 3,600,000; whites, 9200. Differential count; large mononuclear, 8 per cent; small lymphocytes, 21 per cent; eosinophiles, 4 per cent.; neutrophiles, 67 per cent.

During her first stay in the hospital her temperature was never higher than 99.6° F., and usually was normal. Her pulse varied

between 70 and 90. She was put upon a liquid diet, given potassium iodide thrice daily in increasing doses for three weeks; Carlsbad salts, one drachm every morning; unguentum hydrargyri over the liver. As her bowels moved more frequently the color of the movements changed from white to dark brown, and the tumor in the region of the gall-bladder disappeared. With it left the yellow of the conjunctivæ and the bile from the urine. As the urine increased from twenty ounces to one hundred and six ounces, the pus in it diminished, though never disappeared. Red blood-cells were no longer found, nor were casts. Sugar was never found in her urine at this time. During her stay she had a very severe attack of pain in the left hypochondrium. She suffered considerably from night sweats, which gradually improved. On leaving the hospital, May 1, 1902, the tenderness over the liver and the area of gall-bladder enlargement had entirely disappeared. The digestion was better, and the patient seemed on the road to a slow but sure recovery.

After leaving the hospital, the patient was better until August. In August, September, and October she again had attacks similar to those described above. In August, a tumor was to be felt in the right epigastrium; in September, it could not be felt, but the abdomen was very tender over this area. In this month very great tenderness developed over the left kidney. In the October attack, about two weeks before re-entering the hospital, and three and a half before death, she passed large quantities of urine, in which sugar was for the first time discovered, amounting to 2½ per cent., and within four days disappearing entirely. She was now having constant pain in the epigastrium, distress after eating, high fever during the attacks of pain, with almost constant night sweats, and a steady loss in weight.

October 28, 1902. Readmitted to hospital for observation and treatment. Patient had been rapidly losing weight, so that her general appearance was one of great emaciation. Pulse, 80; respiration, 20; temperature, 100.8° F.

4 P.M. Pulse, 80; respiration, 20; temperature, 102° F. Bowel movements now yellow; had not been clay-colored for some months. Stools contain bile. Not examined for fat until after the operation, when small amounts were found.

Urine.—Forty to ninety ounces, acid, 1020, no sugar. Trace of albumen; no casts; considerable pus.

She was very emaciated and anæmic; no jaundice. Lungs, heart, and thorax negative.

There was an area of tenderness and rigidity over right upper quadrant of the abdomen, mostly in the epigastric half, just to the right of the median line. No dulness in the sides. Moderate tympany over the rest of the abdomen. Liver-dulness to free margin of ribs. No enlarged splenic dulness.

She complained of constant pain over the area of epigastric dulness. She had exacerbations of pain in the right side, and after her admission she had a very severe attack of pain develop in the left side anteriorly, when the muscles there were so rigid and this area so tender that a pyonephrosis with a perinephritic abscess was thought to be present in addition to the epigastric trouble. These lumbar pains were always relieved for a time by hot applications.

No tumor could be felt in the epigastrium on account of the extreme rigidity of the abdominal walls; but there was a distinct increase of tension over the most tender area,—a space the size of a dollar just to the right of the median line half-way between the xiphoid cartilage and the umbilicus. The constant pain over this area became a thing of minor importance to her during the attacks of pain in the lumbar regions, particularly the left.

Her digestive system was very much upset. She vomited at the least provocation. There was a tendency to diarrhœa, with blood in the stools.

Course in the Hospital.—After a day her temperature came to normal; pulse always between 70 and 80; leucocyte count on admission, 22,200, dropping to 13,400 in forty-eight hours. Stomach remained upset, and she did not gain; had considerable sweating at night.

On November 3 the pulse rose from 70 to 90. Temperature from normal to 101.8° F. The leucocytes rose to 26,000, and, as she was decidedly losing ground, an exploratory laparotomy was decided upon for a possible chance of relief. At the time of operation, we recognized that there were two distinct conditions with which we had to deal,—one, a suppurative condition of the kidneys probably tubercular, involving both organs in all likelihood; the other, some lesion involving the digestive apparatus,—stomach, liver, gall-bladder, or pancreas. Though no very posi-

tive diagnosis was made, an exploratory laparotomy was thought to be indicated.

On November 4, 1902, we performed a laparotomy, incising over the area of epigastric tenderness just to the right of the median line. Two cysts of the pancreas were opened,—one, the size of an orange, presenting between the lesser curvature of the stomach and the left lobe of the liver, in which two stones were found; the other the size of a walnut, behind the first one, and apparently having no connection with it. They were both aspirated, drained, and packed, the posterior one through the anterior, which was in turn sutured to the abdominal wall. The patient was returned to her bed as soon as possible. She grew continually and rapidly worse after the operation. She was able to retain but little in her stomach, and her bowels moved continuously, so that it became impossible to nourish her; she passed but little urine during the first few days, and died on the fifth day after operation without signs of peritonitis, but with her former symptoms exaggerated. There was but little discharge from the cysts, and the skin about the wound was not irritated. The fluid removed from the cysts contained no pancreatic ferments and was sterile. The stones contained calcium salts.

Autopsy.—This had to be done through the wound and hastily. There was no evidence of peritonitis or leakage. No fat digestion in mesentery or surroundings. The pancreas, with its cysts, the gall-bladder, cystic, common, and portion of the hepatic ducts, with pyloric end of stomach and about four inches of the duodenum were removed in mass. The autopsy developed the fact that there was no left kidney, so that all her intense pain in the left lumbar region was most probably from the calculi in the pancreas, a symptom given by some as differentiating pancreatic from choledochous calculi. The right kidney was half again as large as normal, and contained numerous abscesses the size of chestnuts in its cortex. The specimen removed showed the cystic, hepatic, and common ducts patent. The gall-bladder walls were slightly thickened, but no calculi were found in the bladder. The pancreas was greatly atrophied and calcareous particles were found throughout its duct. At the orifice of Wirsung's duct was a stone the size of a small marble, which almost entirely obstructed its lumen, and at the same time partially filled the opening from the duct into a third cyst the size of a walnut, not felt

at the time of operation because it was not under tension, as the opening was still patent. The other cysts were entirely separated from the duct, at the nearest point by only one-eighth of an inch. These conditions were interesting as showing the history of some cyst formations. The large one anteriorly, opened at the time of operation, in which two stones were found, had evidently been produced by the stones in the duct; the stones passing through into it, and finally the cyst closing behind them. It was a cyst of long formation, as no digestive ferments were found in it. The early jaundice was produced either by a preliminary swelling in the head of the pancreas as the common duct passed directly through it; or, the passing of a pancreatic stone into the ampulla of Vater; or, thirdly, by a biliary stone in the common duct which had made its exit into the intestine. This last supposition is quite improbable, as there were no other stones in the gall-bladder or evidence of any having passed through its duct either in the history or autopsy findings.

The microscopical report, for which I am indebted to Dr. Mary Halton, Pathologist of St. Luke's Hospital, shows an advanced stage of interlobular pancreatitis with the islands of Langerhans still well preserved, verifying Opie's observations that in this type the appearance of sugar in the urine occurs only at the very last stages of the disease.

TUBERCULOSIS OF THE FEMORAL, INGUINAL, AND ILIAC LYMPH NODES SECONDARY TO FOOT WOUNDS.[1]

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TUBERCULOSIS of the femoral, inguinal, or iliac lymph nodes is relatively uncommon. Wohlgemuth, Noorden, Poisson, and Balman, who have together given the location of tubercular lymph nodes in more than 700 cases, which they have analyzed, give the percentages of inguinal involvement respectively as $^{9}/_{10}$ of one per cent., 1 per cent., no per cent., and 5 per cent., making no separate mention of femoral or iliac nodes.[2]

The entrance of tubercle bacilli into the system through wounds in the skin is also a rare occurrence. The bacilli ordinarily gain entrance into the system through the respiratory tract, and the danger of inhaling dust which may contain them is very generally understood. They do not, however, often find their way into an open wound; tubercular wound infection is so uncommon as to be considered among the surgical curiosities.

Yet within four years nine cases of tubercular femoral and inguinal lymph nodes have been admitted to St. Mary's Free Hospital for Children, 15.8 per cent. of the entire number of patients with tubercular lymph nodes who were admitted to the hospital during that time; in eight of them inflammation of the iliac nodes is also recorded, and it is believed that it existed in the ninth. In all but two of the cases there is good evidence that the infection was received from foot wounds, and there is little doubt that it was so received in these two.

The following record illustrates the appearance and course of the inflammation in the most virulent case of the series.

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[1] Read before the New York Surgical Society, January 28, 1903.

[2] "Krankheiten der Lymphgefässe, Lymphdrüse und Blutgefässe," Dr. Friedrich Fischer, Deutsche Chirurgie, Lieferung 24a.

J. K., a well-nourished, otherwise healthy boy of six years, was admitted to the hospital on September 27, 1898, having cut his foot about a month previously, and having a bunch of enlarged lymph nodes just below Poupart's ligament on the same side. The foot wound had healed. The boy had a temperature of 102° F.; the nodes were acutely inflamed, and were removed on the following day. They were found to be about the size of large hickory nuts, of uniform soft consistence, without visible necrotic or caseous spots. They were considered to be simple hyperplastic lymph nodes infected from the foot wound, and the incision was expected to heal promptly. Such healing, however, did not follow; two weeks after the first operation there was a marked enlargement of the inguinal nodes, and the boy had a temperature of 104° F. These nodes were therefore removed through an incision above Poupart's ligament. They presented the same gross appearance as the others,—the size of large hickory nuts, on section rather soft and of a uniform pinkish color, with no visible caseous or necrotic spots,—the typical appearance of hyperplastic enlargement; on microscopical examination, however, they were found to be tubercular.

For the next seven weeks there was a slight purulent discharge, the temperature ranging from about 99.5° to about 100.5° F.; more enlarged nodes could then be felt on pressing deeply into the pelvis over Poupart's ligament, and on December 2 another operation was done.

An incision was made above Poupart's ligament from the anterior superior iliac spine to the pubic crest, the peritoneum was retracted upward, and several nodes were dissected from within the pelvis along the iliac vessels. On May 19, the discharge still continuing, a little tubercle tissue and a few more nodes were removed through a similar incision. At about this time he also showed evidences of spinal tuberculosis in the middle dorsal region, for which he was treated with a spinal brace. He was under observation until October 7, 1899, spending the summer at the summer branch of the hospital at Norwalk, Connecticut. At that time there was still a very slight discharge from the inguinal wound, but his general condition was good; his spine was doing well. He was seen again six months later; the sinus was then healed, but the spinal caries was progressing. Soon after that he contracted diphtheria, from which he died.

The infection in this case was most virulent. It progressed steadily within eight months from foot wound to dorsal spine, although four attempts were made to check it in its course through the lymphatics, all palpable nodes being removed each time. The infection of a bone was contrary to the general law in lymphatic infection and may be considered an exception.

Instead of narrating the details of the other histories in turn, I will group those subjects which seem of the greatest interest.

THE CHARACTER OF THE SKIN WOUNDS.

CASE I.—Sluggish ulcer over tendo Achillis, one-half inch in diameter. Excised and found to contain tubercle tissue.

CASE II.—Wound in sole of foot two months ago, which became infected, and subsided very slowly under treatment. Entirely healed when patient came to hospital.

CASE III.—Slight wound in sole of foot two months ago. Child goes about barefoot; mother had bad cough; she dressed wound, which healed in about four weeks. A similar second wound formed three and one-half weeks before admission to hospital.

CASE IV.—Five months ago he stepped on a rake and cut his foot. The wound healed under treatment, but opened again two months ago. Since then it has alternately healed and broken open. (Now healed.)

CASE V.—No statement as to foot wound.

CASE VI.—No statement as to foot wound.

CASE VII.—Had a slowly healing sore on foot about a month ago.

CASE VIII.—When admitted there was a sluggish ulcer on inner surface of ankle, one-half inch in diameter. Its duration was not known.

CASE IX.—Cut foot in a swamp eight months previously. The wound had alternately healed and opened during that time. When admitted to hospital it looked like a spot of lupus.

Thus in all the cases but two there are distinct histories of sluggish foot wounds.

In one instance this ulcer was excised and found to be

tubercular. In another it was not excised until it had been curetted, and then no tubercle tissue was found.

In six instances the wounds were healed when the patients came to the hospital.

In one there was a sluggish ulcer, which healed in the hospital.

CONDITIONS PREDISPOSING TO TUBERCULAR INFECTION OF WOUND.

In only two instances was there anything about the family history of the patients which indicated the source of the infection. In one of these the father had phthisis; in the other the mother had a chronic cough, " worse of late," and she dressed the foot.

All the children were accustomed to go barefoot, and all lived in tenement houses.

THE GENERAL COURSE OF THE DISEASE.

In this there were few variations, excepting that some infections were more sluggish and persistent than others, and some patients suffered from other complicating diseases.

The duration of the primary sore on the foot varied from less than one month to about eight months.

The femoral lymph nodes about Scarpa's triangle were regularly the first ones to become noticeably enlarged; then the infection of the inguinal nodes above Poupart's ligament followed, and then the nodes within the pelvis along the external iliac vessels.

In one instance the popliteal nodes were also noticeably involved in the inflammation, breaking down and forming an abscess.

The process is slow and tiresome. In all but one case, although the wounds showed no operative infection, there were sluggish sinuses or granulating areas which only healed after long periods of treatment, carried on in some instances outside the hospital, and in one instance the child came back, several months after first leaving the hospital, on account of

a persistent sinus in the popliteal region. Another patient had a most persistent vesicular and bullous dermatitis as a complication. Other patients had measles and diphtheria.

The length of time for which the patients were under observation was as follows: 54, 23, 61, 244, 88, 119, 365, 124, and 410 days.

An average of 165.3 days.

The long duration of the illness of the last patient was due to the sluggish popliteal sinus.

PROGNOSIS.

The prognosis is apparently good. The local inflammation was healed in every case but two when the patients were last seen, and in these instances only small granulating sores remained, which were healing satisfactorily. In only one instance was there evidence of tuberculosis in other parts of the body; that one whose history has already been given in detail had dorsal Pott's disease.

Three of the patients were seen respectively eleven, fourteen, and eighteen months after leaving the hospital, and were in vigorous health.

One patient died of diphtheria.

The remaining five patients had moved and could not be traced.

None of the patients showed swelling of the leg or other ill effects from the removal of the lymphatics.

TREATMENT.

The study of this group of cases leads one to bear in mind the possibility that enlarged femoral lymph nodes may be tubercular, and as soon as the diagnosis is made to advocate the removal of the nodes from the femoral, inguinal, and iliac regions.

In four of the cases this thorough removal was done at once, and for them the average duration of treatment was sixty-four and one-quarter days.

In four others only the femoral nodes were removed at the first operation, and in a fifth only the femoral and inguinal; the average duration of treatment for these cases was 246 days, or, if we deduct the prolongation of the treatment, which was due to complications, it was still more than twice as long as in other cases. A secondary operation and removal of the nodes within the pelvis was necessary in every instance but one, and in that one it probably would have been advantageous.

METHOD OF OPERATION.

For the removal of these three groups of nodes, a vertical incision is begun below the apex of Scarpa's triangle and carried just above Poupart's ligament, where it is joined by a transverse incision which extends from the anterior superior iliac spine to the crest of the pubic bone. The femoral nodes can be removed through the vertical incison, and after the inguinal nodes have been removed through the transverse incision, the aponeurosis of the external oblique may be divided just above Poupart's ligament. The fibres of the internal oblique and transversalis muscles and the transversalis fascia may be drawn up as in the operation for ligation of the external iliac artery, and their attachments divided as far as the ends of the incision, and access gained to the iliac fossa, so that the greater part of the external iliac vessels can be explored and the accompanying lymph nodes removed.

In these cases this seemed sufficient, as the examining finger could detect no nodes beyond those which were removed.

Lennander (*Centralblatt für Chirurgie*, 1899, No. 37), however, advocates a more extensive operation. Externally, his incision is carried over the outer third or outer half of the iliac crest, and at the inner end of the incision Poupart's ligament is divided from the pubic crest. This permits exposure of the pelvic and retroperitoneal nodes as far as the middle of the common iliac artery, or even to the bifurcation of the aorta. I see no reason why this should not be done in suitable cases; but for all those which have come to my notice, it has not seemed best to weaken the inner attachment of Poupart's liga-

ment or the aponeurotic attachments at the crest of the ilium by this extensive incision. I should, however, practise it on finding a case in which it seemed necessary in order to remove the nodes.

CONDENSED HISTORIES OF THE CASES.

CASE I.—F. N., aged two and one-half years; history No. 12, Vol. v. Admitted May 26, 1900. There was a granulating sore on the left heel half an inch in diameter, duration unknown. Two weeks ago painful swelling in left groin.

NOW. In left femoral and inguinal regions mass of lymph nodes size of child's fist. Fluctuation at lower part of mass.

Operation, June 11, 1900. Nodes removed from femoral, iliac, and inguinal regions, size of hickory nuts and filberts. One large and several small ones removed from within the pelvis. Small drain. August 3, discharged at brother's request. Wound nearly healed. Pathological report: Ulcer over tendo Achillis showed tubercle tissue. Lymph nodes tubercular.

CASE II.—F. W., aged nine years; history No. 5, Book v. Admitted September 20, 1900. Two months ago received wound on sole of right foot. Wound was infected and femoral adenitis followed, which has persisted to the present time.

NOW. Femoral lymph nodes enlarged just below Poupart's ligament; mass, three by one inches; skin not attached. Moderate tenderness. Wound on foot healed.

September 21, nodes from femoral, inguinal, and iliac regions removed, varying in size from hickory nuts to beans. October 7, wound healed. Pathological report: Tuberculosis with necrotic areas in the largest femoral nodes. The iliac nodes were enlarged, but did not show tuberculosis.

CASE III.—R. H., aged five years; history No. 329, Vol. ix. Admitted October 2, 1901. Two months ago received slight wound on sole of foot. Wound was very slow to heal; discharged four weeks. Five weeks ago mother noticed large lump in right groin. Lump increased in size slowly and became very painful. Three and a half weeks ago received second wound on foot; character same as first. The foot wounds were dressed by mother, who had a bad cough.

NOW. Suppurative femoral lymph nodes, small ulcer on sole of foot.

October 4, femoral lymph nodes removed. Size of mass, two and one-half by one and one-half inches. One small superficial node resting on the mass had necrotic areas. There were many other nodes in the inguinal and iliac regions. The others were of uniform consistency, soft, without necrotic areas. Five or six were removed from within the pelvis, the largest about the size of a filbert. Small drain. December 4, discharged cured. Pathological report: Tuberculosis of lymph nodes. No examination of tissue from foot wound was made.

CASE IV.—H. S., history No. 36, Vol. i. Admitted February 1, 1898. Five months ago he stepped on a rake and cut his foot. Wound was sluggish, healing under treatment, but opened again two months ago. Since then it has alternately healed and broken open. It is now healed. An abscess formed below Poupart's ligament, which was opened about two months ago in another hospital. The wound was sutured, but broke down, and has been granulating ever since.

NOW. Granulating wound just below Poupart's ligament, sluggish appearance, induration of lymph nodes about it. Child developed measles, was transferred to Willard Parker Hospital. Soon after return, bullous and vesicular dermatitis (probably due to potassium iodide), which persisted until about April 15. April 25, excision of femoral and inguinal nodes, and curetting. July 9, similar operation repeated. September 30, discharged cured.

CASE V.—J. R., aged seven years; history No. 7, Book v. Admitted September 6, 1899. For eight weeks has had painful swelling just below Poupart's ligament, which was opened at another hospital, where it has been treated for six weeks.

NOW. Mass of broken-down lymph nodes just below Poupart's ligament on the right side.

Operation, September 6. Nodes removed and sinus curetted. November 3, nodes have appeared above Poupart's ligament, and are removed from inguinal and iliac regions. One node from within the pelvis was the size of a filbert. Small drain. November 27, wound healed. December 2, discharged cured. Pathological report: Tubercular lymph nodes.

CASE VI.—W. C., aged two years; history No. 9, Book v. Admitted June 4, 1900. Last August, a swelling appeared just below Poupart's ligament on left side. In a short time abscess formed, opened, and has discharged ever since.

Now. In left femoral region mass of nodes size of child's fist. There is a discharging sinus on the inner side of the thigh, three inches below the mass.

June 6, mass of nodes removed from femoral region. Incision carried above Poupart's ligament and several similar nodes removed from inguinal and iliac regions. Those within the pelvis were smaller and less advanced in inflammation than the femoral nodes. Small drain. June 15, nearly healed. July 18, sent to summer branch of hospital at Norwalk. October 1, returned from Norwalk in good condition, with wound healed. Discharged cured. Seen April 26, 1902. Good scar, no palpable nodes. Child in vigorous health. Pathological report: Tubercular lymph nodes.

CASE VII.—J. K., No. 6, Vol v. History given in the text.

CASE VIII.—J. G., aged four years; history No. 359, Vol. x. Admitted August 31, 1901. A few days ago a swelling appeared in the region of Scarpa's triangle, which has been accompanied by acute pain. There is an ulcer, half an inch in diameter, on the inner surface of the right ankle. Its duration is not known.

Now. Healthy looking boy. There is a mass about two by one inches below the middle of Poupart's ligament, which is red, hot, and painful. The ulcer on the ankle shows sluggish granulations.

Operation, September 13, 1901. Three lymph nodes removed from below Poupart's ligament, about the size of hickory nuts, and a number of small ones, ulcer curetted. October 18, second operation. Incision above Poupart's ligament, and four similar large nodes were removed from within the pelvis, the largest, three-fourths inch by one inch. The consistency was soft, the surface was slightly mottled. Remains of the ulcer were excised. January 5, 1902, discharged improved, with a very small granulating area. December 7, 1902, in vigorous health. No evidence of enlarged lymph nodes. Pathological report: Lymph nodes showed tubercle tissue. Curetting from ulcer not examined. Cicatricial tissue of ulcer which was excised showed no tubercular tissue.

CASE IX.—W. F., aged eight years; history No. 10, Vol. v. Admitted April 13, 1899. Last August cut his left foot. The wound would nearly heal and then break down again, and after a time a swelling appeared in left femoral region and another in front of the leg, near the foot.

Now. Child appears fairly healthy. There is a lupus-like spot on the sole of the foot. An abscess is pointing on the inner side of the leg at the junction of the upper and middle thirds. There are several large lymph nodes in the femoral and inguinal regions.

Operation, April 14. Curetting of the sole of the foot. Incision of abscess over the tibia. Many femoral and inguinal lymph nodes were removed. June 30, nodes were removed from the pelvis above Poupart's ligament. Sinus in leg curetted. August 15, sent to summer branch at Norwalk. October 7, returned to New York in good condition, but with a small sinus still persisting in leg. Discharged improved. December 13, readmitted. A small abscess over the anterior surface of the tibia. Abscess opened and some nodes removed from popliteal space. Discharged improved April 21. Readmitted May 6, with the wound in leg still discharging. May 28, wound healed. Discharged cured. Seen July 12, 1901. Healthy and vigorous. No evidence of enlarged lymph nodes or any other tubercular inflammation.

CONTRIBUTION TO THE LITERATURE OF OLD IRREDUCIBLE DISLOCATIONS OF THE SHOULDER-JOINT.[1]

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CASE I.—One afternoon, in the fall of 1889, a young farm laborer presented himself with a subcoracoid dislocation of the shoulder-joint of three months' duration. He stated that he had fallen from a horse to the ground; on attempting to get up, he had felt an intense pain in the shoulder, and found that he could not move the arm. He sent a messenger for a physician, who, on his arrival, placed him under an anæsthetic, and believed he had accomplished a reduction. He stated that his pain was severe, that the immobility of the arm remained after regaining consciousness, and had continued to the time of his visit to the writer.

On examination, there was presented the usual unmistakable picture of a subcoracoid dislocation. He was placed on the examining table for the purpose of ascertaining the degree of fixation of the humeral head in its false position. While the elbow was being pressed to his side, the arm was gradually rotated outward to its utmost limit, using the forearm as a fulcrum. The head could plainly be seen to move towards the glenoid fossa. Then the elbow was moved forward and towards the median line to a point almost below the nipple; the forearm was suddenly moved from its position of extreme abduction to adduction, and, to our astonishment, the humeral head suddenly assumed its normal position in the glenoid cavity. The arm was fastened by means of a wide roller bandage with the forearm flexed across the chest, and maintained in the position for four weeks, when the case was discharged, with every prospect of acquiring useful function.

In consulting the literature at my command at that time,

[1] Read before the Western Surgical and Gynæcological Association at St. Joseph, Missouri, December 29 and 30, 1902.

several cases were found where reduction had been effected at varying periods of from a few weeks to a year, some by one method some by another, usually, however, after the use of considerable force. The manipulations used in our case, known as the Kocher method, had proved so effective that we were led to hope as much from this procedure as had been realized in recent cases, until a second case presented itself a few months later, a case referred by Dr. H. P. Jensen, of Omaha.

CASE II.—A muscular young laborer who had sustained a subcoracoid dislocation about five months previously. He stated that he had fallen from a height, striking on his right hand while the arm was in an abducted position. Several unsuccessful attempts had been made at a reduction. He carried his arm in an extended position, being utterly unable to flex it. The extremity was swollen, presented a purple color, was very painful, and in the usual subcoracoid position. When first seen he was placed in the recumbent position, but, on attempting to use the Kocher methods, they caused so much pain that further efforts in that direction were abandoned until he was placed under chloroform anæsthesia. All manipulations—extreme abduction, adduction, inward and outward rotation—failed to move the head of the humerus from its subcoracoid position. Prudence seemed to dictate that the utmost limits within bounds of safety had been reached in our manipulative endeavors, so nothing remained to be done but to liberate the humeral head by a free incision. Not being prepared for such an undertaking, and not having the consent of the patient, he was allowed to recover from his anæsthesia, and at a later date arrangements were made for an open operation at his home.

Operation.—Dr. H. P. Jensen administered chloroform. Our assistant disappointed us by his non-arrival, so that the writer was obliged to act as his own assistant. After disinfection of the shoulder, an incision was made, beginning over the acromion process and extending five inches downward directly over the empty glenoid cavity and parallel with the deltoid fibres. The glenoid cavity, covered by a thickened and contracted capsule, was exposed. The humeral head rested under the coracoid process. It was impossible to expose it through this incision, so it was continued forward and inward over the shoulder to the cora-

coid process. Now the coracobrachialis and the short head of the biceps came into view in the upper part, and the pectoralis major in the lower part of the wound. The pectoralis major and the subscapularis were nearly separated from their attachment to the humerus, which partly exposed the head. Outward rotation broke the newly-formed costal adhesions, but the head could not be moved towards the glenoid cavity until the coracobrachialis and the short head of the biceps had been divided. The tear in the joint capsule had closed; the capsule itself, having become a fibrous mass, was excised. The humeral head was replaced with some difficulty with the assistance of an elevator and outward traction on the arm, while Dr. Jensen clasped his hands under the patient's armpits and produced counter-traction. The divided muscles were sutured as nearly as possible in their proper position and the wound closed with a tubular drain. Union was complete in ten days. Passive movements were installed at once, and in the course of two months fairly good, passive motion was obtained.

CASE III.—Referred by Dr. J. C. Moore. D. T., a laborer, who had sustained a subcoracoid dislocation two months previous to his admission to the Methodist Episcopal Hospital. It was explained to the patient that an attempt would be made to reduce the dislocation by manipulation, and, if not successful, open operative measures would be instituted at once, to which he agreed. Accordingly, he was placed in deep chloroform narcosis. The Kocher method was tried repeatedly, but failed. The heel-in-axilla procedure and extreme abduction, traction, and counter-traction yielded no better results. But these manipulations had evidently broken up the adhesions, because the head could be moved almost to the margin of the glenoid cavity. An incision, beginning over the acromion process and extending downward five inches, exposed the head of the humerus covered by the subscapularis and pectoralis major. These muscles were divided, the head coming fully into view protruding through its capsular rent, which had firmly contracted. The thickened fibrous capsule was excised. The head, which was unchanged, readily slipped into its place by Kocher manipulation. The wound was closed as in the preceding case. Union in ten days. Passive movements were begun, and, in a month more, fairly good function was obtained.

CASE IV.—E. D., a robust ranchman, came to the Methodist Episcopal Hospital from western Nebraska. His left arm was extended and abducted, swollen, and painful. He had sustained a subcoracoid dislocation four months previously by being thrown from a horse. After he had given his consent to any procedure, his shoulder was disinfected and he was placed under chloroform.

Manipulations by the Kocher method were attempted. The bone had become firmly adhered beneath the coracoid process, so that the movements could affect the bone no more than if osseous union existed. The efforts at outward and inward rotation were increased, when suddenly, with a snap, the humeral head seemed to have been dislodged from its bed of adhesions. The humerus could easily be placed in its normal position, but, on palpation, the *head* of the humerus could still be felt in its former position under the coracoid process. It was now plain that a fracture of the surgical neck had been produced. Now arose the question whether to fix the arm so as to maintain it in as nearly a normal position as possible, or should the capsule and the separated head be removed? The thing most desired by the patient was relief from pain. It was impossible to know whether the separated head was pressing on important nerves. If it could be determined that by leaving the head the arm would be free from pain, there really was no other indication for an incision. Nothing could be gained by extirpating the capsule, since the end of the humerus could easily be held in place. The prospects for a pseudarthrosis were better with the capsule undisturbed. On the contrary, if the capsule were extirpated, the chances of an osseous union were to be reckoned with. It was further recalled that it had been recommended in old irreducible subcoracoid dislocations that the head be severed with a chain-saw and allowed to remain.

It was decided to fix the arm so that the end of the humerus would be held in place, allow the patient to recover from his anæsthesia, and, if the old pain persisted, to extirpate the severed head at some subsequent period. Much to our delight, all pain had disappeared; consequently, the arm was maintained in its corrected position for four weeks, when passive movements were instituted. A pseudarthrosis developed and useful function was obtained.

CASE V.—A. F., aged thirty years, railroad laborer, admitted to St. Joseph's Hospital. As a result of an explosion, he had sus-

tained about six months previously a subcoracoid dislocation of the right shoulder and a fracture of the right femoral neck. Ineffectual attempts at reduction had been made. The head of the humerus could be brought to the glenoid cavity, but immediately returned to its subcoracoid position when the arm was released. Accordingly, his physician, who is an excellent surgeon, made an incision over the shoulder and through the deltoid, and found that the rent in the capsule was contracted to such a degree that it prevented the head from being drawn through it. The rent was enlarged, permitting complete reduction. The wound was closed and united *per primam*. The arm was fixed in the usual way. The case did well apparently for two or more weeks, when the humeral head gradually passed from the glenoid cavity to its former coracoid position. In this condition he was sent to St. Joseph's Hospital.

On examination, the upper end of the humerus was found as before described, and there was a firm, smooth cicatrix over the outer aspect of the shoulder. The fracture in the right femoral neck had not united.

Operation.—Several days after his admission an incision was made, beginning at a point over the site of the coracoid process (which could be felt), and extending outward to a point over the middle part of the glenoid cavity and then downward for five inches. After turning down this flap and partly dividing the pectoralis major, the exploring finger came in contact with a fragment of bone, which proved to be the fractured coracoid process. This fragment was separated from its attachments and removed. The greatly thickened capsule was then clipped away. The head of the bone, the cartilage of which was eroded, was brought towards the glenoid cavity by means of traction, rotation, and the assistance of an elevator. It was found that the head could not be brought into the glenoid cavity because of muscular shortening, which made it rest against the acromion process. The head was removed with a chain-saw. The end of the humerus now rested in the glenoid cavity. The wound was closed and a tubular drain inserted in the lower end of the incision. The wound healed throughout, except at the point of drainage, where an infection of moderate degree took place. The functional result was fairly good. He was also provided with an ambulatory traction splint for his hip-joint.

CASE VI.—W. M., aged fifty years, ranchman, admitted to the Presbyterian Hospital. He stated that about four months previously he had fallen and "put his shoulder out." Ineffectual attempts at reduction had been made, the attendant finally stating that the bone was in place. But when the swelling had disappeared, it became evident to him that his shoulder was not right.

On examination, the arm was found to be extended, painful, swollen, œdematous, and could not be flexed. The head of the humerus was found in the subcoracoid position. The following day, under chloroform anæsthesia, by manipulation the head could be transposed to the anterior margin of the glenoid cavity, but no farther.

An incision in the pectorodeltoid interval was made, the cephalic vein encountered and pulled outward and backward, the pectoralis major almost completely severed, and the capsule extirpated with great difficulty. The subscapularis, the infra- and supraspinatus, teres major and minor were divided. Efforts at reduction seemed to be opposed by both the long and short heads of the biceps, which were both divided. The head was then, after several ineffectual attempts, elevated to its proper place; the tendons and muscles were reunited with catgut and the wound closed. Union *per primam*. At the present time the articular movements are still limited, but, on account of the free mobility of the scapula, he is able to perform manual labor.

CASE VII.—Mrs. M. P., aged fifty years, farmer's wife, was admitted to the Methodist Episcopal Hospital. She stated that three years before she had been thrown from a wagon, falling on her shoulder. The medical attendant diagnosed a sprain. She was unable to move the arm at the shoulder, and had not done so since the accident. The arm was semiflexed at the elbow. The shoulder and arm were atrophied, the forearm œdematous and swollen. There had been constant pain, requiring the daily use of morphine for the entire period of three years.

On examination, the head of the humerus was resting on the anterior margin of the glenoid fossa. On movement, the scapula followed every excursion of the arm, indicating probably bony union. The patient came with the urgent request for immediate amputation. Preparations were made, and the patient placed under chloroform the following day. Manipulations now demon-

strated positively that bony ankylosis existed and could not be broken up.

An incision over the head of the humerus and a blunt separation of all the soft parts revealed that we had to deal with an old subluxation, complicated with an impacted fracture of the head of the humerus and a separation of the anterior margin of the glenoid cavity. The real nature of the injury not having been recognized, the bones became firmly united in this position. The head of the bone was removed with a chisel immediately below the lesser tuberosity. The glenoid fossa was freed of its capsule, the end of the resected bone placed against it, and the wound closed. It healed without complications. The pain all disappeared, and from last accounts had not returned.

Seven cases are not enough to draw general conclusions from. While, in a general way, they were all alike, yet in their details there were no two the same. In each one there were conditions unlike those of all the others; so we must consider them in the light of a contribution to a subject that is large. No one surgeon can have a large experience in old irreducible shoulder-joint dislocations; so each one of us must contribute his mite in order that the surgical statistician may formulate general rules for our guidance.

The first question to take into account is, What are the obstacles in the way of reduction? Charles Nélaton, who considered this subject at some length (in the *Archives Générales de Médecine,* October, 1888), arrived at the following conclusions: "(1) That the principal obstacle in the reduction is the retraction of the disused capsule; (2) that this retraction presents two phases,—the first, during which the lips of the capsular opening tightly encircle the head of the bone, and in that way prevent its return to the glenoid cavity which is free and ready to receive it; the second, in which the head cannot again enter the glenoid cavity, not only because it is thus held by the edges of the capsular rent which permitted its escape, but also because the articular cavity has become too small to receive it, owing to the narrowing and atrophy of the capsule; (3) that these two causes of irreducibility indicate two methods of treat-

ment,—the first being amenable to traction and passive movement, the second requiring operative interference." (Quoted from the *American Journal of the Medical Sciences,* Vol. xcvi, p. 634.)

Our first case belonged, evidently, to the first class, on account of the ease with which it was reduced. At that time the writer had not become familiar with Kocher's method, so that the success in that case must be ascribed to a lucky chance rather than to any skill.

"M. And. Castex details (*Revue de Chirurgie,* October 10, 1888) six cases of reductions of old luxations of the shoulder by means of a method which consists essentially in using the semiflexed arm as a lever, and causing the head of the humerus to execute the movements of external and internal rotation, flexion and extension, abduction, adduction, and circumduction. In this way he claims that, in the majority of cases, all adhesions may be broken up and the head of the bone replaced more certainly and more safely. If the first attempt fails, he recommends making the second after an interval of three days, the consecutive inflammation producing softening of the adhesions." (Quoted from the *American Journal of the Medical Sciences,* Vol. xcvi.)

While we have not tried repeated manipulation at different times, still, from the limited experience in our cases, success by the Castex method would seem to be rather due to good luck than otherwise. The head had "lost its right of domicile" owing to the fact that the firm, hard capsule had become embedded in a mass of extensive, newly formed, cicatricial tissue which offered a bar to manipulative reductions that could only have been overcome by an operation.

The most classical and complete consideration of this subject in recent times, we find to be by Edmond Souchon, of New Orleans, and appears in the *Transactions of the American Surgical Association,* Vol. xv, p. 311. He has made a study of 154 operated cases which he collected from the literature. He found that some twenty difficulties and complications were mentioned by the different surgeons dealing with these cases:

" Capsule thick, dissection tedious, reduction difficult; excessive fibrous tissue around the head and surgical neck; head deeply seated, head adherent to ribs, extensive muscular dissections; old fractures of the tuberosities, of the glenoid cavity, and of the humerus; glenoid cavity filled with the remnants of the capsule and fibrous tissue; glenoid cavity readily freed or cleared; parenchymatous hæmorrhage during operation, wounds of vessels during operation, rupture of the axillary artery in trying to reduce before and after cutting, and various sundry difficulties."

In our cases we encountered nearly all the obstacles mentioned by Souchon and nearly all the difficulties and accidents during and after operation, except the wounding of the large axillary vessels (in 4 per cent.) and necrosis of the head (in 16 per cent.) which he mentions.

Souchon divides his cases into two chief classes, (1) recent irreducible, (2) old irreducible. All of our cases belonged to the second class. While we could hardly expect a reduction by manipulation, owing to the contraction of the capsule so constant in these cases, we did succeed in one. The chief object of manipulative efforts was to break up fibrous adhesions, and thereby facilitate reduction, and possibly save a large part of the dissection otherwise necessary.

In brief, we may say that our plan has consisted chiefly of

First, manipulation. Using the forearm as a lever, rotating outward and inward, abduction and adduction, never forgetting for a moment a possible accident to the axillary vessels and nerves, and the possibility of fracturing the humerus. If this plan failed,

Second, through incision the capsule and all cicatricial tissue were extirpated. All muscular attachments that offered a restraint were severed, the axillary vessels were protected with a broad, flat retractor, and the head of the bone was brought into place by means of an elevator assisted by manipulation and traction. To avoid infecting the wound in this last manœuvre, it is advisable to firmly wrap the entire arm and hand with wet sublimate towels. Dry towels are liable to slip and become dis-

placed, making it possible for the operator's hands to become infected. If the head cannot be replaced, then

Third, the head of the humerus should be resected. This is an operation to be avoided when possible, on account of the resultant flail-like condition of the arm, and yet must be done (*a*) when the humeral head and neck become too extensively stripped of their attachments, experience having shown that necrosis may occur in 16 per cent. (Souchon) of the cases; (*b*) when osseous union has occurred between the head and the ribs; (*c*) when, after a division of all the restraining, soft parts, the head rests against the point of the acromion process.

AN OS TRIGONUM DETECTED BY THE RÖNTGEN RAYS.

BY HENRY PERKINS MOSELEY, M.D.,

OF NEW YORK,

Radiographer to the Presbyterian Hospital in the City of New York.

THE following case is here presented as being interesting from the stand-point of clinical surgery and also pure anatomy, as it was thought at first to be a fracture of the astragalus, and later shown to be an os trigonum. It has also a medicolegal bearing on the question of the detection of obscure fractures by the means of the Röntgen rays.

The case was treated at the Presbyterian Hospital in the service of Dr. A. J. McCosh, at whose suggestion and through whose courtesy it is reported.

A. M., aged twenty-seven years, was admitted to hospital November 30, 1902, with the history that on the night before admission, while he was helping move a piano, he slipped, and he and the piano fell a whole flight of stairs, the piano striking him on the left leg with the knee flexed, and jamming him against the wall. Soon after the injury he noticed pain and partial loss of function in both the knee and the ankle.

When admitted the left leg was considerably swollen and bruised from the foot to half-way up the thigh. The knee was swollen, and there was evidence of much fluid in the joint. The ankle was swollen, tender, and œdematous, with abrasions over the inner aspect. *Manipulation over the tarsal bones caused pain.* There was much *deep ecchymosis.* There was no crepitus nor false point of motion made out. " No fracture of tarsus or metatarsus made out, but one suspected."

Under cold applications and lead and opium dressings, the ecchymosis and swelling disappeared. Slight pain still remaining, a radiograph was made of the ankle (Fig. 2). The hospital note of that day, December 4, being " X-ray photograph shows a fracture of the astragalus, a portion of its posterior aspect being

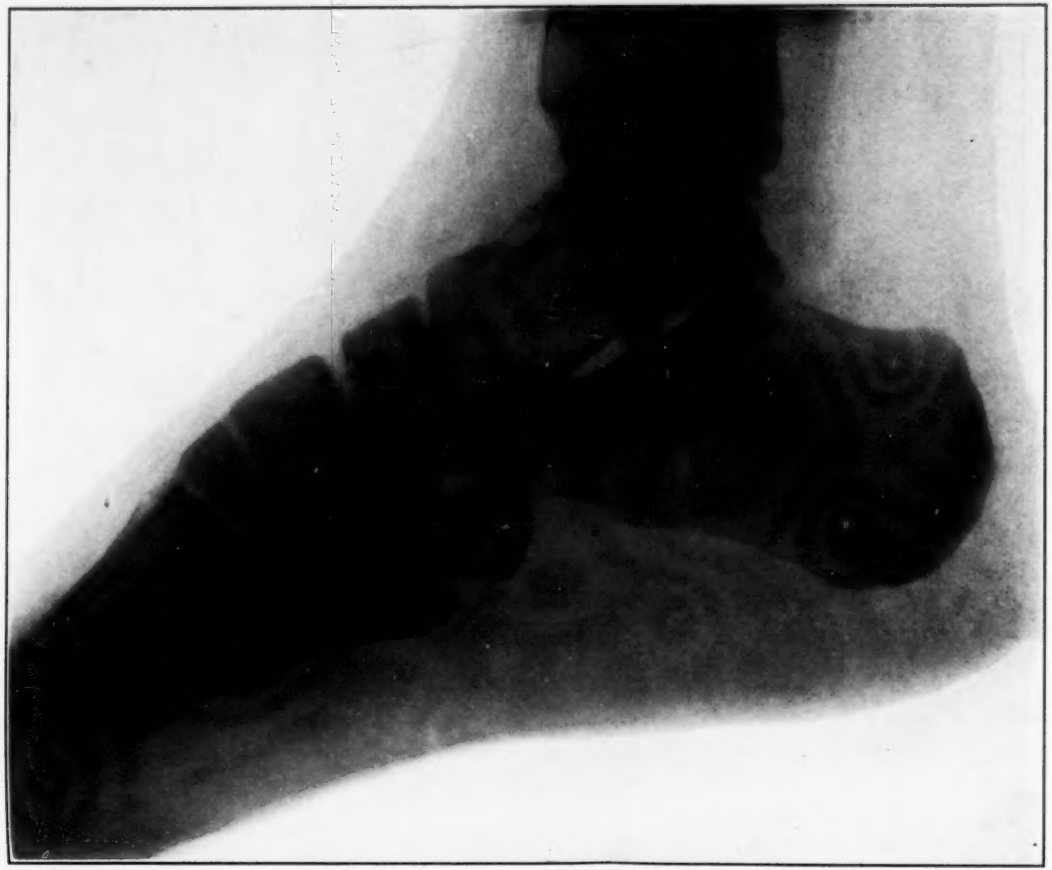


FIG. 1.—Normal foot, showing outline of astragalus.

FIG. 2.—Injured foot (left), showing os trigonum.

FIG. 3.—Uninjured foot (right), showing os trigonum.

chipped off." The tenderness in the ankle, however, rapidly disappeared, and the patient was allowed to leave the hospital on crutches on December 9. On December 19, when he presented himself again in the out-patient department, all tenderness had left the ankle, which was, however, the seat of a slight general thickening. The patient was walking without crutches. There was no crepitus obtainable, no false point of motion, and no localized point of tenderness. A radiograph taken then was a duplicate of the first. It was thought that the abnormal shadow might be a chipped-off lower end of the fibula, but a radiograph made in the anteroposterior plane showed the tibia and fibula normal at the ankle-joint. The suspicion that there might here be an abnormal bone was confirmed by a radiograph of the uninjured foot (Fig. 3), in which the same shadow appears.

Dr. George S. Huntington, Professor of Anatomy in the College of Physicians and Surgeons, to whom the writer is indebted for suggestions and for references to the literature, said it was undoubtedly the shadow of an os trigonum,—an abnormal tarsal bone,—which was described by Bardeleben in 1883.

An os trigonum, according to Quain, is an ossicle due to the separation of the external tubercle on the posterior surface of the astragalus and its ossification from a distinct centre. The flexor longus hallucis tendon passes in a groove on the posterior surface of the astragalus, and it is the outer ridge bounding this groove which becomes separated and ossified from a distinct centre.

The fact of the rapid return of function in the ankle-joint after the injury called our attention to the possibility of error in the diagnosis. After the radiograph showed so plainly what appeared at first to be a fracture of the astragalus, the diagnosis of fracture seemed certain. It was not until the possibility of fracture of the other bones had been excluded, and the other foot showed the same abnormal bone shadow, that the conclusion arrived at was warranted.

Such a radiograph as indicated by Fig. 2, if the only one of the series shown, might be very misleading, if any medico-legal question had arisen over the case.

The technique of the radiographs was:

Coil. Twenty-inch, made by Heinze Electric Company, of Boston.

Interrupter. Heinze liquid, making 5000 interruptions per minute.

Tube. Heinze's; vacuum equivalent to a parallel spark gap of one-quarter inch.

Current. One and one-half ampères passing in the primary coil.

Plate. Cramer Crown.

Exposures. Ninety seconds.

Developer. Pyro and Cramer contrast.

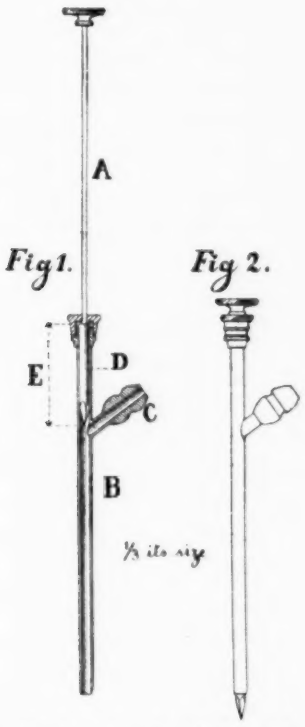
REFERENCES.

Quain. Anatomy, tenth edition, Vol. ii, Part I, p. 133.
Anat. Anzeiger, 1889, 305.
Schwalbe. Morph. Arbeit., Part II, Jena, 1893.

AN ASPIRATING TROCAR.

BY EDWARD H. OCHSNER, M.D.,
OF CHICAGO.

THE accompanying cut illustrates a little device which I had one of our local instrument makers construct for me about two years ago. It represents a trocar which combines in a very simple manner the essential principles of a trocar and an aspirating syringe.



Combined trocar and aspirating syringe.

A in the figure represents the part which acts as stylet in a trocar and as piston in a syringe; B acts as trocar tube and as syringe barrel; C is small arm which acts as spout, and which may be attached to an ordinary aspirating syringe by means of

a rubber coupling tube. If, now, the stylet is withdrawn so that its point is above the level of arm C, a vacuum is formed in tube B. At times this is sufficient to start the flow of fluid. If the fluid is very thick, it must be helped along by the additional suction of an aspirating syringe.

In order that a vacuum is always produced in barrel B when A is withdrawn, the part of stylet A must of course fit perfectly in tube B; and in order that the instrument be a useful and desirable one, it must do this not only the first few times the instrument is used, but it must continue to act perfectly during the whole life of the instrument, which should be at least two years. This desired result is accomplished by making stylet A as well as tube B of steel, and by working them with the same care and in the same manner as in constructing an ordinary all-metal syringe.

During the two years preceding the construction of this instrument I had made a very extended search in instrument houses and armamentariums of hospitals for a trocar that would fulfil the above requirements. I found several that attempted to do this; but all that I have been able to find and try were disappointing. They were all made of ordinary trocar metal or depended upon packing to accomplish the desired result. The material used in ordinary trocars is either nickelled brass or German silver. Both of these alloys are soft, and after the trocar has been boiled half a dozen times or more in the ordinary instrument tray with the rest of the instruments, the trocar tube becomes indented here and there and the instrument is ruined.

It would seem almost superfluous to call attention to the fact that it is practically impossible to pack a trocar of a No. 9 or No. 11 French scale caliber, the ordinary sizes, and have it so packed that it will stand boiling any considerable number of times.

I have asked a good many abdominal surgeons why they had discarded trocars in gall-bladder operations. So far as I now remember, they all gave me essentially the same answer: "They are all unreliable." It is because of this same experi-

ence, plus the desire of having a trocar that always works, that I began to make a study of trocars some four years ago, and believe the above instrument fulfils all requirements. If the instrument is constructed according to directions, I believe it will always work. The one we are now using has been used in over one hundred gall-bladder operations and in numerous other conditions, such as the aspiration of synovial and pleuritic effusions, and it is in perfect working order to-day, and has not disappointed us in one single instance. In the meantime it has been boiled with all the other ordinary surgical instruments at least five hundred times.

It is very important, however, that the instrument be properly constructed. As said before, both the stylet and the barrel must be made of steel and so ground that parts D and E fit perfectly. Every instrument should be tested in the shop before it is sent out, and again by the surgeon before it is accepted. If this is done, I feel confident it will give satisfaction.

This instrument will be found to be especially useful in infected conditions of the gall-bladder, as with it one can remove the fluid contents of the gall-bladder without the slightest danger of soiling even the outer surface of this viscus, to say nothing of the protection it offers against the soiling of the other intra-abdominal organs or the abdominal incision.

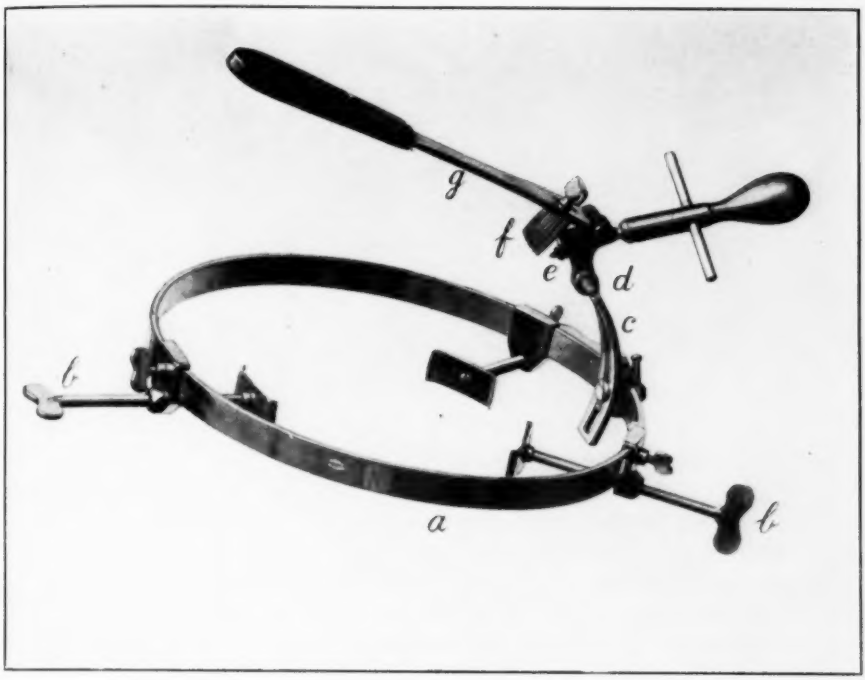
I call attention to this instrument thus in detail because I am told by the local instrument maker that quite a good many of these trocars are being bought by surgeons all over the country; and recently I procured one myself which seemed exactly like the first one I had constructed and am still using with satisfaction, but which proved to be worthless, because it was made of ordinary trocar metal instead of being made of steel. A trocar which may fail at a critical point in a gall-bladder operation is worse than useless, and for this reason it is very important that it be properly constructed.

A NEW OSTEOPLASTIC TREPHINE.

BY W. BARTON HOPKINS, M.D.,

OF PHILADELPHIA.

THIS instrument, through the firm fixation of its centre-pin and the powerful control of its cutter, renders the forming of large osteoplastic cranial flaps comparatively easy and very expeditious. It will cut a three-inch bone-flap in from three to five minutes, and it cuts so smoothly that the shock from cranial jar is, in this preliminary step to operations upon the brain, avoided. Its adjustment may be carefully and deliberately effected as follows: The circular frame (*a*) is clamped by set-screws (*b*) to the head in a position which will bring the adjustable bracket (*c*) approximately over the proposed site of operation, and in a plane beneath the greatest diameter of the head. The pressure of the pads of the set-screws need not be excessive; they can be brought to bear on points best able to stand pressure, and they are made to adhere closely to the integument by covering their surfaces with rubber adhesive plaster, adhesive side out. The curved bracket is next set by a binding-screw in a position which will bring the centre-pin (*e*) nearly in place, when a small incision is made into the scalp to receive it. The final and accurate adjustment is then completed by setting up the lock-joint (*d*) while the centre-pin is held absolutely perpendicular to the cranial dome. The drill-point of the centre-pin is then, by a few turns of its handle, made to engage in the bone. A circular incision of the integument may be made with a scalpel in a line indicated by a gentle impression of the teeth of the cutter (*f*), or a knife may be inserted in the notch of the lever corresponding to the size of the proposed flap. The notches 1, 2, 3, and 4 in the lever, in one of which the cutter is held by the binding-screw, cut flaps two, two-and-a-half, three, three-and-a-half inches in diameter.



OSTEOPLASTIC TREPHINE.—*a*, circular frame; *b b b*, set-screws, to which pads are applied; *c*, curved adjustable bracket; *d*, lock-joint; *e*, centre-pin with drill-point; *f*, cutter; *g*, lever handle.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 28, 1903.

The President, LUCIUS W. HOTCHKISS, M.D., in the Chair.

DISLOCATED SEMILUNAR CARTILAGE OF KNEE.

DR. ALEXANDER B. JOHNSON presented a man, thirty years old, a fireman by occupation, who, June 1, 1902, while descending a ladder slipped, and violently abducted his right knee. He felt something snap in the joint, and upon attempting to run he found his knee-joint weak, and he was almost powerless to use the limb. A severe synovitis followed. After the effusion had subsided, he was able to use the limb, but any sudden abduction, or a blow from within outward on the inner aspect of the foot, resulted in his knee giving way under him. He always felt something slip out from the interior of the joint. He was usually able, by manipulation, to push back the projecting body on the inner aspect of the knee, between the tibia and femur.

The patient presented himself for treatment at the hospital in August. Examination of the right knee showed moderate effusion into the joint. Upon certain motions of abduction and flexion the internal semilunar cartilage could sometimes be made to slip out from between the condyles. An operation being decided on, a horizontal cut was made upon the inner aspect of the knee, opening into the joint, which contained a moderate amount of synovial fluid tinged with blood. The internal semilunar cartilage was found torn loose from all its attachments as far back as its posterior and internal fourth, at which point there was a rupture of the cartilage, leaving it attached by a narrow isthmus at its

posterior border. The larger fragment, composing about three-quarters of the cartilage, was removed. The joint was washed out with salt solution and closed by sutures. The limb was placed upon a posterior splint and kept quiet for a fortnight. The wound healed without complications, and two months ago the patient was able to resume his arduous and difficult occupation as a member of the fire department.

The motions of the knee-joint are perfect. He has no pain in the joint, but states that occasionally, upon making a sudden muscular effort, he feels and hears a snapping in the interior of the joint. This symptom is not accompanied by pain or disturbance of function. The knee-joint is normal in appearance. He wears a knee-cap made of some elastic material.

CHOLECYSTECTOMY.

DR. JOHNSON presented a woman, aged forty-seven years, who was admitted to the hospital August 18, 1902. Excepting for a constipated habit of the bowels, she had always enjoyed vigorous health until five months ago, when she was suddenly seized with a severe shooting pain in the right hypochondrium, radiating through to the back and scapular region. This attack was accompanied by a chill and vomiting. There was no jaundice. The acute pain lasted about ten hours, and was followed by a more or less continuous pain of moderate severity, which persisted until the occurrence of her second severe attack; this was similar in character to the first attack and occurred about seven weeks ago. The patient became jaundiced during this attack, the jaundice persisting, with characteristic symptoms, for six weeks.

A third severe attack of pain occurred two weeks ago, which was not accompanied by jaundice, A dull pain in the region of the gall-bladder has continued up to the present time.

Upon admission to the hospital, an examination revealed a well-nourished patient. She was slightly jaundiced. No tumor could be felt through the thick abdominal wall, but there was tenderness upon deep pressure over the region of the gall-bladder. The liver was not enlarged. At the time of her admission, the patient's temperature was 100° F.; pulse, 80. An examination of the blood showed 64 per cent. of hæmoglobin and 12,200 leucocytes. The urine was normal, excepting that it contained bile pigment.

The patient was operated on August 22, 1902, four days after her admission to the hospital. A vertical incision, four inches in length, was made downward, beginning an inch below the ninth costal cartilage. The gall-bladder was found to be moderately enlarged; it contained numerous stones, which were readily palpated. There were but few adhesions, and the gall-bladder was but loosely connected to the liver structure. It was separated from its attachments as far down as the cystic duct and then cut away. The cystic duct was found to be patent downward into the gut, admitting a good-sized probe throughout its entire length without difficulty. The cystic duct was surrounded by a purse-string suture and inverted. A strand of gauze, surrounded by rubber tissue in the form of a wick, was introduced down to the stump of the cystic duct, and the remainder of the wound was closed by sutures. The bleeding was inconsiderable. The wound healed *per primam,* leaving a sinus from which a small amount of bloody serum continued to escape for several weeks. There was no discharge of bile, and convalescence was uninterrupted. The patient was allowed out of bed on the twenty-first day, and left the hospital in good general condition three days later. Since then her general health has remained good.

The report of the pathologist was as follows: The gall-bladder measures six by two and one-half centimetres, and contains twenty light colored, slightly faceted calculi, the largest being one centimetre in length. There is considerable thickening of the wall of the gall-bladder; section shows extensive loss of its epithelial lining, and chronic inflammation of all the coats. The thickening is largely due to a deposit of fibrous tissue in the subperitoneal coat. Cultures made from the interior of the gall-bladder remain sterile.

EXCISION OF COSTAL CARTILAGE AND PARIETAL PLEURA FOR RECURRENT CARCINOMA OF THE BREAST.

Dr. Ellsworth Eliot, Jr., presented a woman, fifty-eight years old, who was admitted to the Presbyterian Hospital, May 21, 1900, with the following history. Eighteen months previous she had noticed a small lump in the right breast. This gradually increased in size, and in October, 1899, ulceration of the skin took

place. This ulceration had existed about seven months at the time of her admission to the hospital.

Inspection of the right breast showed a mass about the size of a pineapple, which extended three and one-half inches to the right, two and one-half inches above, and one inch below the nipple. This mass was movable on the deeper parts. No enlarged glands could be felt in the axilla. May 23, 1900, the mass was removed by a wide excision, including both pectoral muscles and the axillary contents. Subsequently, there was some infection from the ulceration, and the patient's temperature rose to 104° F. It gradually fell to normal, and the wound closed without further complication. An interesting feature of the operation was that although the glands in the axilla were apparently normal in size and appearance, yet upon microscopical section they showed beginning carcinomatous infiltration.

The patient left the hospital in less than three weeks after the operation. She was seen from time to time and carefully examined, but there were no signs of a recurrence until November, 1901,—that is, about eighteen months after the operation. The patient then returned, and said that about six weeks before she had noticed a small lump two inches below the cicatrix. This lump was quite firm; the skin covering it was discolored and slightly adherent, but it had not ulcerated. Without any delay the tumor was excised, together with the underlying costal cartilages and parietal pleura. This operation was done through an elliptical incision. When the pleura was opened, there was no apparent disturbance of either respiration or circulation. The left lung popped up into the wound, and the heart could be seen pulsating through the adjacent pericardium. The parietal pleura was stitched to the lung and the external wound was closed. No reaction followed the operation, and there was complete expansion of the lung on that side. The wound closed by primary union.

A microscopic examination of the growth showed that it was carcinomatous in character, similar to the original breast tumor. The costal cartilage had also become invaded by the cancerous tissue.

Fourteen months had elapsed since this second operation without any signs of further recurrence. At the time of the primary operation, the middle and lower subscapular and the posterior thoracic nerves were left untouched, and in consequence

of this, the patient has excellent use of her arm, notwithstanding the loss of the pectoral muscles.

Dr. Howard Lilienthal said he had had some experience in the excision of the ribs, together with parietal pleura; and in one case he met with an accident which he believed might happen to any one. In the case referred to, he attempted to suture the parietal pleura to the lung. Following this operation, there was a valve-like formation, and the patient got up a tremendous acute pneumothorax, which threatened his life. The perforation through which the air entered could not be located, and aspiration was resorted to. The patient subsequently died of an abscess of the lung, for which the operation had been originally undertaken.

Dr. Lilienthal said that some time ago he presented a case at one of the meetings of the Surgical Society where he had excised a section of pleura about two inches by three inches in size. The case was one of melanotic sarcoma of the rib. In that instance he made no attempt to suture the pleura, but packed the wound tightly. The patient recovered without a single untoward symptom. Although it was usually advised to resort to suturing in these cases, the speaker said he did not regard it as a reliable procedure; he would place more reliance on packing.

Dr. Willy Meyer said he had had two operations of this kind, both being instances of recurrent carcinoma of the breast, with involvement of the costal cartilage. In one, where evidently the anterior aspect of the cartilage had become involved, he succeeded in stripping the parts off the parietal pleura; in the other he tried to do the same, but the pleural cavity was accidentally opened. He lost no time in packing the wound as tightly as he could, and no immediate collapse of the lung followed, but at the end of the second day a profound collapse of the lung on that side occurred.

Dr. Meyer said that whenever it was possible, he would stitch the lung to the parietal pleura and close the wound at once. If this was impossible, he would resort to packing. In the case he had referred to, where air entered the pleural cavity and was followed by collapse of the lung, it took many weeks for the patient to recover.

In reply to a question, Dr. Meyer said there was no regional recurrence in the case where he had left the costal pleura. Some

time later a disseminated cancer appeared, to which the patient succumbed after a while.

Dr. Arthur L. Fisk said it seemed to him that the procedure resorted to by Dr. Cabot in the treatment of empyema might be advantageously employed in these cases. Dr. Cabot uses a sheet of rubber tissue which overlaps his dressing by about one inch. The rubber tissue prevents the entrance of air into the pleural cavity on expiration, but on inspiration permits of free escape of any that is inside.

Dr. Hotchkiss said he had had one case of carcinoma of the breast in which there was a recurrence three years after the primary operation, involving the second right costal cartilage. This was removed without opening the pleura. The patient died in a few months of a mediastinal growth, which was probably present at the time of the second operation.

Dr. Eliot, in closing, said that he did not think the removal of cartilage without the underlying pleura a valuable measure, owing to the probability of involvement of the latter structure.

He also said that collapse of the lung and severe respiratory and circulatory disturbances were more apt to occur in those cases where a small opening was made in the pleura than in those where the pleural cavity was freely opened, the small opening acting as a valve.

Dr. Eliot referred to another case of recurrent carcinoma of the breast in which the primary operation had been done in New Haven, in April, 1900, eighteen months after the onset of the disease. About a year after the operation the patient came to the Presbyterian Hospital with a recurrent tumor at the inner angle of the cicatrix. It was about the size of an orange, slightly ulcerated, and firmly fixed to the underlying costal cartilage. An operation was not deemed advisable, but the patient insisted. The case was treated practically in the same way as that which he had presented, but the postoperative developments were entirely different. Owing to the necessary extensive sacrifice of skin, a hole was left in the pleural cavity large enough to admit a man's fist. During the operation no change was observable in the patient's respirations, nor was the pulse-rate increased; but, owing to the ulceration, the wound suppurated and an ordinary empyema developed, with temperature elevation, and an increase in the pulse and respiration. After the fourth day, these acute symptoms de-

creased in severity, and the patient's recovery was not otherwise interrupted. The operation was done eighteen months ago, and up to the present time there have been no indications of a further recurrence, although the resulting abscess cavity is still slightly discharging, and the extensive denuded area over the chest has not entirely cicatrized.

CHOLECYSTECTOMY AND CHOLEDOCHOTOMY.

Dr. Charles L. Gibson presented a man, sixty-nine years old, who entered the hospital last August, giving a history of having had symptoms of intermittent jaundice and cholelithiasis for about two years. A year ago he had had a severe attack of jaundice, and since then intermittent attacks. When he came into the hospital he was deeply jaundiced, and in such poor general condition that an immediate operation was not deemed advisable. After keeping him under observation for several weeks his jaundice largely disappeared, and the clotting quality of the blood increased. On the 10th of August, 1902, the abdomen was opened, and on exposing the gall-bladder it was found to be much distended, resembling in appearance a loop of intestine. It contained no stones. On opening the common duct, which was readily identified, it was found to be free from stones. The ampulla was found to be greatly dilated, readily admitting a No. 26 French bougie, which indicated that the calculi had probably escaped into the intestine.

After removal of the gall-bladder, the wound in the duct was drained, and the man made a perfectly smooth recovery. Since the operation he had entirely recovered his health and had been free from all pain.

CHOLECYSTECTOMY AND CHOLEDOCHODUODENOSTOMY.

Dr. Gibson presented a woman, thirty-five years old, who was admitted to St. Luke's Hospital in the summer of 1901 with an attack of typhoid fever, from which she made a good recovery. Subsequently she had an attack of gall-stones, complicated with jaundice, for which an operation was advised, but the patient refused, and left the hospital. She returned in July, 1902, and stated that since the previous December she had suffered from attacks of pain in the region of the gall-bladder, with more or less gas-

tric and constitutional disturbance. When she was admitted, there was a slight, fading jaundice, which disappeared entirely before she left the hospital, twelve days later.

When she was readmitted, October 16, she was deeply jaundiced, and was suffering from an attack of typical, biliary colic, dating back six days. When the abdomen was opened, November 13, 1902, Dr. Gibson found a stone so tightly wedged in the ampulla that it was impossible to dislodge it. In order to gain access to it and remove it, it was necessary to open the duodenum transversely and slit up the ampulla. The gall-bladder was then removed, and the patient made a satisfactory recovery.

DR. LILIENTHAL thought the operation of duodenostomy ought to be avoided if it possibly could be. Recently he had a patient with a large-sized stone in the ampulla, upon whom he performed cholecystectomy, and at the same time removed the stone. He succeeded in doing this by rotating the duodenum, pushing the stone between the pancreas and gut, thus bringing it up into the wound, and then incising the ampulla and removing the stone. Immediate suture of the duct was practised. The patient was fully convalescent within a week after the operation and very promptly recovered. Dr. Lilienthal said that if a small leak remained in the intestine after doing a duodenostomy, it was very apt to become larger, and the patient was in danger of dying of starvation. He recalled such a case, which he saw in the hospital last summer, in charge of one of the other surgeons, where the patient died of inanition due to a leak in the duodenum. Although duodenostomy had been advocated by men of high standing, and while it was comparatively simple and theoretically a good operation, still, it entailed an opening into a section of the bowel which should not be interfered with, if possible.

As to the original incision in these cases, Dr. Lilienthal said he preferred the straight incision through the fibres of the rectus to the transverse cut made by Dr. Gibson. He had found that the former answered every purpose, both in the simple removal of stone from the common duct and in cholecystectomy. Through such an incision, the hepatic and common ducts could be drawn up into the wound and manipulated and examined with great exactness.

INTESTINAL OBSTRUCTION BY BAND.

DR. GIBSON presented a man, forty-two years old, who entered the hospital December 25, 1902, with the history that he had had no movement of the bowels for a week. His previous history was negative, with the exception that one year ago he had a fairly acute attack of appendicitis.

When Dr. Gibson first saw the patient, there was fæcal vomiting. The abdomen was much ballooned, and there was a point of great tenderness in the right hypogastrium. An incision was made in this region, revealing a peculiar condition of the surface of the liver; it was roughened by numerous small elevations, not unlike a tuberculous condition, for which no satisfactory explanation could be offered. Below the liver a loop of intestine was found which was unevenly dilated. The real cause of the intestinal obstruction proved to be a cord-like band binding down two loops of gut and strangulating a third loop underneath. This band was divided, thus relieving the strangulation, and the man made an uneventful recovery. There was no satisfactory movement of the bowels until four days after the operation.

APPENDICOSTOMY (WEIR) FOR THE TREATMENT OF CHRONIC ULCEROUS COLITIS.

DR. WILLY MEYER presented the woman whose case had been mentioned at the last meeting. She was fifty-three years old, and for two years previous to coming under observation had suffered from frequent diarrhœa, sometimes accompanied by pain. During the past three months her symptoms had become aggravated. There were frequent, watery evacuations; these were extremely painful, accompanied by a bloody discharge, and had an exceedingly foul odor. During her recent illness she had lost sixty pounds in weight.

When the patient entered the German Hospital, October 20, 1902, an inspection through the rectoscope showed that the lower bowel was covered with numerous ulcers, and above these a cock's-comb-like granulating mass could be seen. The ulcerations were apparently specific in origin. The entire large intestine was tender on palpation, and it was to be concluded, from the patient's history and the great loss in weight and strength, that similar ulcer-

ations probably extended throughout the entire transverse and ascending colon. Instead of flushing the bowel from below, therefore, it was thought best to make an opening above and introduce the irrigating fluid through the cæcum. If the patient had not been in such a weakened condition, Dr. Meyer said, he might have resorted to the Kader method, as proposed by Dr. Gibson, with reference to colostomy, so that a large-sized tube could be introduced, but, after due consideration, Weir's method of irrigating the bowel through the appendix was decided upon.

October 8, 1902, the abdomen was opened by means of the intermuscular incision, and a comparatively small appendix found. It was drawn through the wound in an oblique direction until its tip protruded about half an inch; the tip of the meso-appendix was then stitched to the subcutaneous fat at the lower angle of the wound. The wound, including the skin, was then closed by layer sutures and the tip of the appendix amputated. A flexible bougie could be passed into the cæcum; its size corresponding to about No. 11 or 12 French, later, also, a soft rubber tube. The opening into the appendix was tied for the first twenty-four hours after the operation, to avoid the danger of soiling the wound. After the first day, the large intestine was regularly flushed through the tube in the appendix, at first with a 1-10,000 silver nitrate solution, followed by a saline solution; subsequently, the strength of the silver nitrate solution was increased. Under this treatment, the health of the patient has materially improved, although there are still some ulcerations in the rectum. She had gained fifteen pounds since the operation. Dr. Meyer considers Dr. Weir's proposition a valuable addition to our operative resources. It certainly is a fascinating idea, of making this use of the otherwise useless organ.

TUBERCULOUS FEMORAL LYMPH NODES.

Dr. Charles N. Dowd read a paper with the above title, for which see page 746.

Dr. A. B. Johnson related the history of a case of tuberculosis of the femoral lymph nodes in the person of a young man who, in the course of an acute gonorrhœa, had developed an adenitis in the groin. The gonorrhœa got well, but the adenitis per-

sisted, and upon removing the enlarged glands they were found to be tubercular. At the time of operating, the speaker said, he did not look for enlarged glands within the pelvis, and he was unable to say whether any were present or not. In the course of a few months the man developed acute phthisis and died within a year.

About a fortnight ago, Dr. Johnson said, he saw a man who had a tuberculous trouble affecting one knee-joint thirteen years before. The joint was scraped at the time, but not excised. The disease speedily recurred, and when he came under the speaker's care, the limb was very painful and enormously enlarged, giving one the impression that the case was one of sarcoma of the femur and tibia. There was a large mass of glands in the femoral region, and also a number in the pelvis and within the abdomen. The case was regarded as practically hopeless, but, in order to give the man some relief, the limb was amputated at the level of the lesser trochanter. Since the operation, which was done only two weeks ago, the enlarged glands have grown much smaller.

Dr. Johnson said he had seen several cases of tuberculosis of the femoral lymph nodes in which, contrary to the experience of Dr. Dowd, the ultimate prognosis was by no means good. The cases he had in mind were those in which the lymphatic nodes of the neck, axilla, and the femoral region were simultaneously affected, or in which different parts of the body became the seat of tubercular disease. In several such cases the autopsy showed that the glands of the mesentery and mediastinum were also the seat of tuberculous disease. The speaker said he recently saw a boy who had a tumor in the right iliac region which was looked upon as the evidence of an acute appendicitis. Upon opening the abdomen, the tumor was found to consist of a large mass of tubercular lymph nodes in the neighborhood of the iliac vessels. Upon the removal of these, the patient made a prompt recovery. The appendix was found to be normal.

Dr. Lilienthal said it seemed to him that the particular interest in the cases reported by Dr. Dowd lay in the fact that they were all instances of inoculation tuberculosis from injuries. They certainly represented a remarkable collection of cases. In the case mentioned by Dr. Johnson, where the patient developed acute phthisis after an attack of gonorrhœa, the probabilities were that

the tubercle bacilli had existed in the lungs or elsewhere before the onset of the gonorrhœa. There was no good reason to suppose that the infection came from the urethra. Dr. Lilienthal said it was not unusual to see inflamed glands in the neighborhood of a suppurative coxitis or an osteomyelitis of the femur, and these are usually looked upon as tubercular, but the cases reported by Dr. Dowd were both unusual and suggestive.

TRANSACTIONS

OF THE

CHICAGO SURGICAL SOCIETY.

Stated Meeting, February 2, 1903.

The Vice-President, A. J. OCHSNER, M.D., in the Chair.

EXCISION OF THE CÆCUM.

DR. JACOB FRANK presented a child nineteen months old. He said that twelve months ago he was called at eleven o'clock at night to see the child, and found it in a critical condition. The history given by the mother was that the child had always been a "colicky" baby. About two months before it was operated upon, its bowels were frequently constipated. Vomiting spells were frequent, but the child had never vomited any fæces. The child was playing on the floor, when suddenly it was seized with a severe pain, vomited, and passed blood, after which it became very ill. He made a diagnosis of intussusception; the mother took the child to the hospital, and at about two o'clock in the morning he opened the abdomen; in examining the coils of intestine he did not find what he thought was a recent intussusception, but in making a further examination he came upon the appendix, which seemed as though it were binding the cæcum down. He removed the appendix, and in following the cæcum he found it was a hard mass. He therefore resected the entire cæcum, making practically two operations. He used one of his absorbable bone couplers in making the intestinal anastomosis, and removed the stitches at the end of seven days. In ten days the child left the hospital. The child was now in perfect health. The specimen was exhibited.

STRICTURE OF THE ŒSOPHAGUS TREATED BY GASTROSTOMY AND GRADUAL DILATATION.

DR. A. J. OCHSNER presented a man thirty-four years of age, who came under his care at the Augustana Hospital February 17, 1899, giving the following history:

Aside from having experienced repeated attacks of malaria, the patient's health has been good since childhood. He lived in a malarial district during his youth. He has never swallowed lye or any other escharotic. During the past fifteen years he has experienced some difficulty in swallowing. He first observed the necessity of drinking large quantities of water while eating, in order to wash down the food. The amount of fluid required has become greater and greater constantly. For a considerable time he has been in the habit of eating and drinking all he expected to consume at one meal; then he would drink several goblets of water, and with a species of straining he would force the entire meal, which apparently had accumulated in the lower part of the œsophagus, into the stomach. Then he would gulp up the superfluous water to the amount of about one pint.

At the time of admission he was well nourished, strong, and muscular, tongue clean, appetite good, bowels constipated. Heart, lungs, and kidneys are normal. Upon permitting the patient to drink one to two pints of fluid, he complains of a feeling of weight in the epigastrium. Percussion elicits an area of dulness in the epigastrium to the left of the median line and upward towards the left nipple. Bismuth was suspended in the fluid swallowed and skiagraphed. This showed a club-shaped shadow in the area indicated by the dulness, twelve centimetres wide at its widest point, which at the same time was the lowest portion.

If patient drinks still more fluid he becomes greatly distressed. He then goes through a convulsive motion, his eyes bulge out similar to the condition seen in children during a paroxysm of whooping-cough. Then suddenly he feels a relaxation, and the greater portion of the fluid has passed into the stomach. The remaining portion is gulped up and the patient is relieved. The regurgitated portion of fluid is free from hydrochloric acid. This condition has become more and more distressing, the patient finding greater difficulty in forcing anything into the stomach. There is as much difficulty in getting water or any other fluid into the stomach as there is in swallowing food of any kind which permits of thorough mastication.

These symptoms indicate the presence of what has been called a spasmodic stricture of the lower end of the œsophagus, but which is probably due to the peculiar arrangement of the muscles of the diaphragm at the point at which the œsophagus passes through

the latter structure in these cases, as has been demonstrated by a case operated by Ross, of Toronto.

Every attempt of passing bougies of any size, even filiform bougies, through the stricture had failed, both with and without the use of cocaine. The patient's condition had become most pitiable, when the following plan of treatment was instituted. The patient was anæsthetized, and another attempt was made to introduce bougies of various sizes, but this again failed. An incision twelve centimetres long was then made through the outer edge of the left rectus abdominis muscle opposite a point half-way between the umbilicus and the sternum. Bougies were again introduced into the œsophagus through the mouth, but could not be passed into the stomach, neither could they be felt with the hand in the abdominal cavity. The anterior wall of the stomach was then brought up and sutured to the parietal peritoneum, and the transversalis fascia and the exposed surface of the stomach between the edges of the abdominal wound were tamponed with iodoform gauze. This part of the operation was badly planned. Some provision should have been made to prevent leakage after the stomach was opened, either by Witzel's method or by some other equally efficient plan.

The stomach was opened two days later and an unsuccessful attempt was made to bougie the œsophagus from below. During the following week attempts were made daily to pass bougies through the stricture, but all of these attempts failed, until a fine flexible bougie found its way into the stomach ten days after the operation. A number of attempts had also been made to pass a thread through the stricture by having the patient drink it with water, but these failed, probably because of the peculiar form of the obstruction. Ordinarily, a fine thread placed in a glass of water and threaded through a drinking tube can be carried through even a narrow stricture into the stomach if the patient drinks the thread with the water through the drinking tube.

The end of this bougie was brought out through the opening in the anterior wall of the stomach, and a large-sized braided silk suture was tied to its end. The bougie was then withdrawn, and in this manner the silk cord was passed through the œsophagus. A still heavier silk cord was now attached to this cord double, and was drawn through the œsophagus; then one of the free ends of the cord was drawn through the loop and tied to the other free

end. In this manner a very convenient continuous double silk cord was placed permanently through the œsophagus, as shown in Fig. 1.

The following day a small rubber tube was looped through this cord and drawn through the œsophagus and left in place in the stricture for a few moments in order to dilate the latter. Then two rubber tubes were looped into the first one, and these were drawn through the constricted portion, as is shown in Fig. 2.

Each day the size and number of these tubes were increased until the mass of tubes measured three centimetres in diameter when tightly pressed together. By this time the patient could swallow any kind of food normally in any desired quantity.

In the mean time, however, the gastric fistula had become very troublesome. One of his assistants, Dr. H. H. Hanstein, devised a very ingenious pneumatic rubber apparatus with which he closed the opening, but the patient insisted on having the fistula closed, and this was accomplished by an operation May 8, 1899, seven weeks after the original operation. The stomach was loosened and the wound closed by means of Lembert sutures. A small fistula persisted for some time, but healed under treatment with cauterization.

It is now four years since the operation, and it is still possible to pass an ordinary olive-pointed bougie fifteen millimetres in diameter into the stomach. This has been done several times each month during the past year, because there has been some tendency to recurrence. Swallowing has become more and more difficult constantly, notwithstanding the fact that it is possible to pass the bougies. It will consequently become necessary sooner or later to perform another operation. The operation advised by Ross, consisting in a division of the constricting bands, will be indicated, and will probably give permanent relief.

Aside from the evident advantages this method presents in itself, it can be employed very satisfactorily in connection with the method described by Abbe as the bowstring method. The bowstring of Abbe can be introduced by means of the endless double silk cord, then a sufficient number of rubber drainage tubes can be drawn into the stricture to make it perfectly tense. In this manner the stricture can be cut, and more readily with the bowstring than it could were its edges in a relaxed condition.

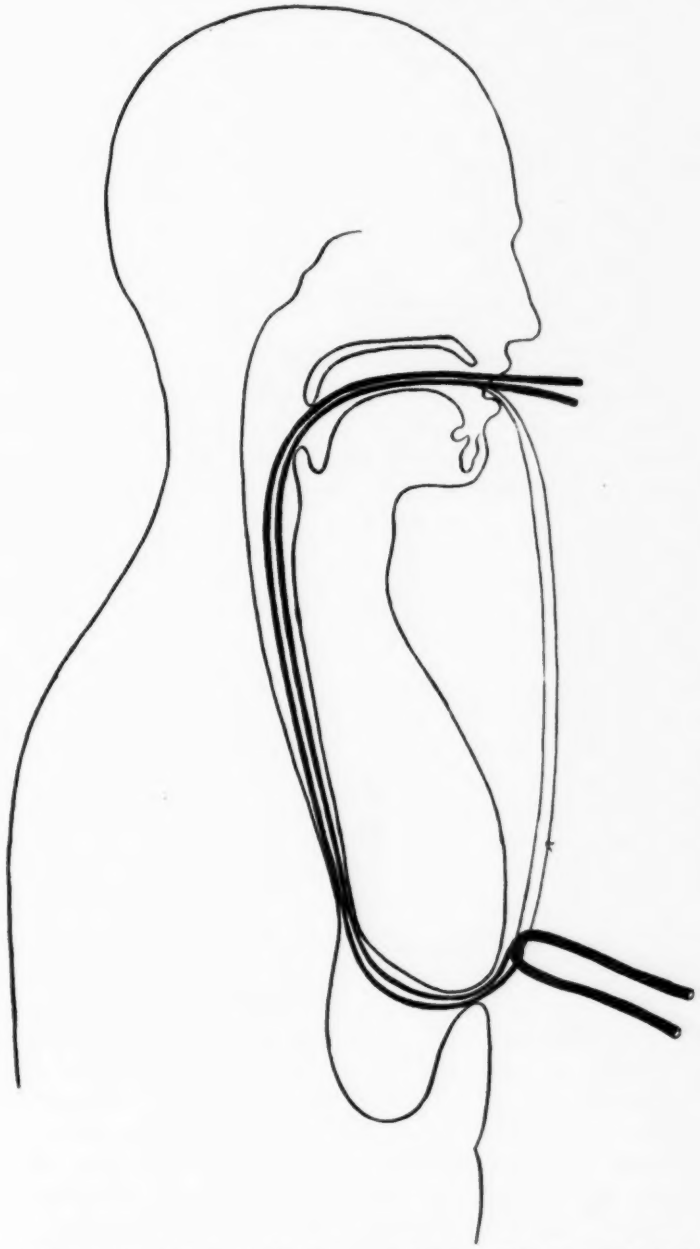


FIG. 1 shows a second rubber tube looped into the first one. This is repeated with larger tubing to increase the dilatation.

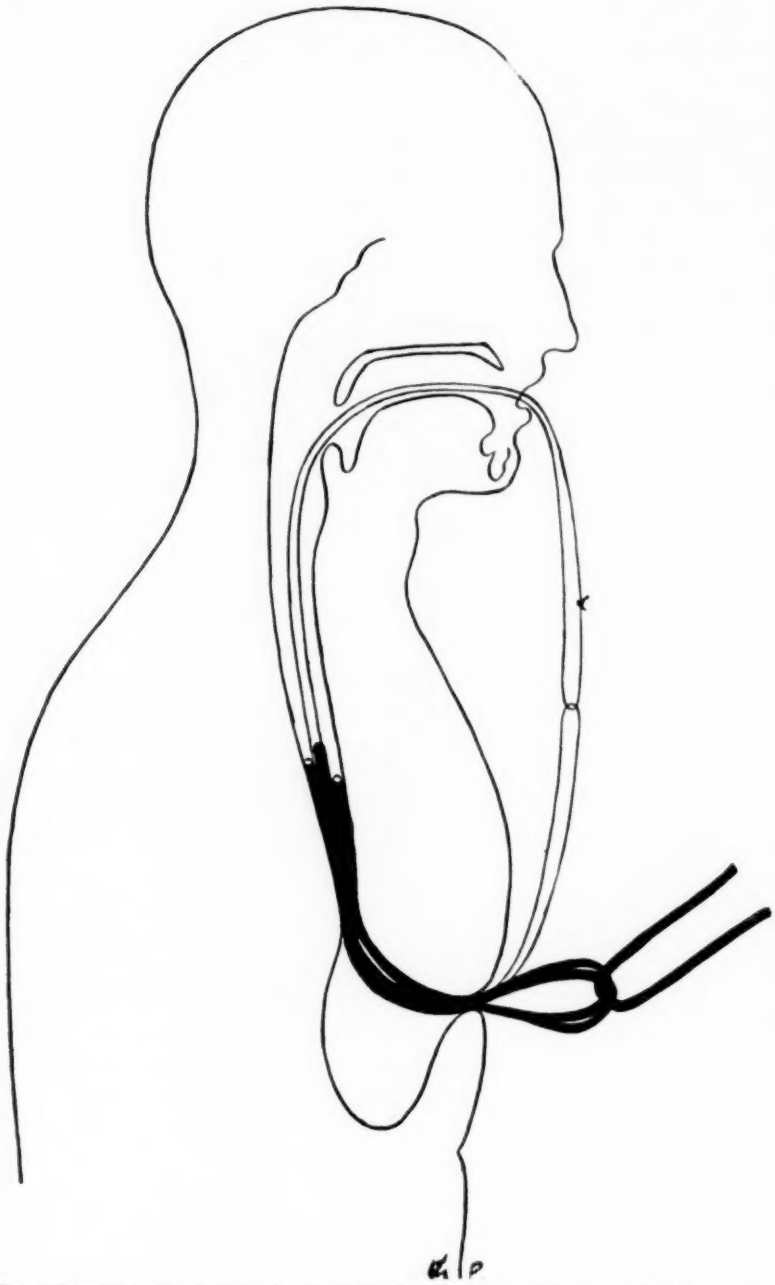


FIG. 2 shows the tubes in the stricture, where they are permitted to remain for the purpose of increasing the dilatation by their own elasticity.

Dr. D. W. Graham stated that the history did not seem compatible with any pathological lesion, and the case did not correspond to a malformation. He had never seen a case of diverticulum of the œsophagus; but while the author was reading his paper, it occurred to him that possibly it might be something of that kind. There were numerous cases reported in the literature.

Dr. A. E. Halstead stated that the question of diverticulum had interested him, because not long since he had operated on such a case. In his case a large bougie could be passed without any difficulty through the stricture, although a small one was impassable. The patient was unable to swallow food of any kind, either fluids or solids. After swallowing a mouthful or two of food, the diverticulum would fill again and close the œsophagus. This was a characteristic point in the diagnosis of a diverticulum. He described on the blackboard the peculiar features of the diverticulum in his case.

Dr. A. I. Bouffleur stated that while he had not had a large experience with the class of cases under consideration, his impression was that some dilatation of a stricture of the œsophagus frequently occurred after a simple gastrostomy without the use of any bougie. With a stricture located as this one was, one ought to be able to dilate it with the finger if the proper method were resorted to, and this method consisted in making an opening in the stomach early in the operation, to empty the stomach, and by having the opening very small, so that it would just pass over the finger, one could carry the hand well up in the abdominal cavity with the finger within the stomach. He remembered seeing Dr. McCosh dilate such a stricture a few years ago, at which time he introduced his whole hand into the stomach. There was serious objection to this, and by invagination the same effect could be secured without so much danger.

In a case which he operated on two weeks ago, he was unable to carry this out, on account of the condition of the patient. The patient had taken absolutely nothing by the mouth for six days, not even a teaspoonful of water, also had expelled promptly any nutrient enemata. In this case he did a gastrostomy, and after opening the stomach he passed a bougie from below up through the stricture without any difficulty. In the course of a week, without any further dilatation, the patient was

able to drink freely, and within three days after this he was able to take boluses of bread. From what he could learn, it was quite a common thing for these strictures to dilate somewhat spontaneously when the congestion and œdema of the parts were relieved by the performance of a gastrostomy.

Dr. Arthur Dean Bevan said there was one point he would like to suggest as to the possibility of the pathology of the condition. Might it not be possible for one to have a stricture of the œsophagus or œsophageal opening in the stomach from a gastric ulcer, just as one would have obstruction of the pylorus, or obstruction from a carcinoma of the œsophageal entrance of the stomach? Would it not be possible to imagine such a condition explaining the pathological condition? The exact cause of the obstruction in Dr. Ochsner's case was not clear to him.

Dr. Ochsner, in closing the discussion, said there was no doubt but what gastric ulcer could cause a stricture at the point mentioned, and in connection with the articles referred to by Dr. Halstead, the condition in some of those cases was similar to a spasm of the sphincter ani muscles in fissure, so that in some of them, by simply washing out the œsophagus regularly and giving bromide of soda and sedatives, the œsophageal spasm became less violent, and presently patients got well without any operative treatment. He saw a case a short time ago in which the food was expelled the moment it was swallowed constantly, for a number of weeks, so that the patient became greatly emaciated, and it seemed as though a stricture of the œsophagus existed. It was possible to pass sounds into the stomach. A gastrostomy was made, and an ulcer found directly opposite the point at which the œsophagus emptied into the stomach, so the moment it entered the stomach it caused a spasm, and the food was ejected at once. The stomach had decreased in size, so that its diameter was less than that of the jejunum.

It seemed to him sensible to give the food a good opportunity to go on into the intestine, so he made a gastro-enterostomy to drain the irritated stomach thoroughly, and immediately the patient began to improve, gain in weight, and she had been gaining rapidly ever since. He thought the method of von Eiselsberg in such cases would be attended with considerable risk, because of the fact that the tube could not be reintroduced if it were accidentally withdrawn.

In connection with the remarks of Dr. Bouffleur, it occurred to the speaker that if he had carried a tube similar to Jacob's catheter, only larger, up through the stomach and out through the mouth, and fed the patient until she had gained sufficient strength so that he could remove the diverticulum which existed, possibly he might have saved her life, but making a gastrostomy and trying to feed the patient in that way seemed too severe an operation, so the patient died from shock.

At the operation in this particular case he tried to invaginate the stomach, but could not insert the stomach wall into the œsophagus, and he felt timid about opening the stomach and examining it from within. This was four years ago, at which time surgeons were more afraid of the stomach contents than they are now. At the present time he would have opened the stomach directly and examined it in that way.

He had no doubt that there was a congenital element in his case. Some time ago a writer, whose name he could not recall, published an article in the *Archiv für klinische Chirurgie*, reporting a large number of sections of the œsophagus, and it was found that there were congenital narrowings at certain points in the œsophagus, and the point at which the œsophagus crosses the diaphragm is one of the points at which there is a natural narrowing. He believed that his patient from childhood had had this narrowing. It was now nineteen years since he began to find it was necessary to drink a lot of water to swallow his food.

REVIEWS OF BOOKS.

CANCER AND OTHER TUMORS OF THE STOMACH. By SAMUEL FENWICK, M.D., F.R.C.P., Consulting Physician to the London Hospital, and W. SOLTAU FENWICK, M.D., LOND., M.R.C.P., Senior Physician to the London Temperance Hospital; Physician to the Evelina Hospital for Sick Children. Pp. 354. Philadelphia: P. Blakiston's Sons & Co., 1903.

Any work that tends to add to our knowledge of cancer, no matter of what part of the body, should be welcome; and when one stops to consider the single question of the difficulty of diagnosis of gastric cancer, he turns eagerly in search of help to any source of information which presents. In the volume before us the Drs. Fenwick offer the result of their personal observations on 265 necropsies occurring in their service at three large London hospitals, together with an analysis of 3679 cases from other sources. The record of so large a personal experience must of itself command a respectful reception; but the most cursory perusal of the book shows that the authors bring to the consideration of their subject a thorough appreciation of its breadth, an attention to detail, a power of analysis, and withal a generous conservatism which bespeak the master craftsman.

The scope, as outlined in the preface, deals with etiology, pathology, and symptomatology rather than with treatment, although a chapter is devoted to that important branch. "As the work has necessarily been written from the stand-point of a physician, we have merely sought to indicate the various conditions which in our experience seem to warrant or to contraindicate surgical interference, and have left all discussions relative to operative

technique to those who are better qualified to deal with the subject."

The relative frequency, and consequently importance, of carcinoma fully warrants the greater space given to that variety of neoplasm, the consideration of which occupies fully two-thirds of the book. About 100 pages are devoted to sarcoma, benign tumors, foreign bodies, and tumors of the duodenum. It is of interest to note that the varieties of carcinoma are classed as "scirrhous," "medullary," and "adenocarcinoma."

Analysis of the authors' own cases seems to prove that, contrary to generally accepted data, both sexes are equally liable to gastric cancer, and that susceptibility increases up to seventy-five years; the death-rate by decades being respectively, 45-55, 23.7 per cent.; 55-65, 29.6 per cent.; 65-75, 24.8 per cent. The rate in the last decade would be much higher could all deaths from cancer be collected, the above including only hospital deaths, and not those occurring in almshouses and other refuges for the aged. The above figures are of particular interest to the Reviewer, as in a home for aged people with which he is connected the eighteen deaths in the last five years include seven from cancer, or 40 per cent. Two of these were carcinoma of the stomach, and there are now in the home two other cases of intestinal carcinoma.

A series of tables is arranged to show the portion of the stomach most frequently attacked, the form of tumor common to each section, the relation of the form and position of the neoplasm to the various symptoms, etc. It would appear from these that pain is most frequent and most severe when the walls and curvatures are attacked, and that growths of the cardia are least painful, while severe pain after meals is suggestive of ulceration. Vomiting is most frequent, as one would expect, in stricture of the pylorus. The authors are inclined to believe that hæmorrhage is much more frequent than is generally supposed, and suggest that constant unsuspected leakage is the chief cause of the cachexia accompanying gastric cancer.

Valuable chapters are devoted to diagnosis and treatment. The tabular arrangement of differential symptoms is particularly to be commended. The difficulty of distinguishing carcinoma from gastric ulcer is dwelt upon at some length.

Commenting on the occasional occurrence of sarcoma, the following differential points are suggested: (1) Sarcoma is more frequent under thirty-five years. (2) Slight continued pyrexia plus rapid and profound anæmia. (3) Splenic enlargement. (4) Sympathetic enlargement of the tonsils and follicles of the tongue. (5) Sarcomatosis. (6) Persistent albuminuria.

Syphilis is included among the less common conditions, and the importance of specific treatment in certain obscure cases of persistent gastritis and relapsing ulcer urged.

HENRY GOODWIN WEBSTER.

A POCKET TEXT-BOOK OF ANATOMY. By WILLIAM H. ROCKWELL, JR., M.D., Assistant Demonstrator of Anatomy, College of Physicians, Columbia University, New York. Lea's Series of Pocket Text-Books. Edited by BERN B. GALLAUDET, M.D. Philadelphia and New York: Lea Brothers & Co.

The purpose of this book is to provide a reference handbook of anatomy. It is not complete enough for a text-book, and at the same time is too large for a compendium. Its usefulness therefore is limited, and will be found of service only to those who wish to make a fairly complete review of anatomy, and to whom the minutiæ are not essential. There are comparatively few illustrations, and these are mostly taken from Gray's "Anatomy," which work has been closely followed by the author in compiling the present book. The manual might be improved by the addition of more illustrations and appropriate tables.

PAUL M. PILCHER.

COMPENDIUM DER OPERATIONS- UND VERBANDSTECHNIK. By DR. EDWARD SONNENBURG and DR. RICHARD MUEHSAM. Berlin: Verlag von August Hirschwald, 1903.

The present work is a hand-book of minor surgery. It takes up the preparation necessary for an operation, anæsthesia, the more elementary operations, the operative technique on the different tissue systems, and the general technique of dressings and bandaging. There are no novelties, and it is, in fact, an exposition of the methods in use at the Moabit Hospital, with occasional references to the methods of other surgeons. The illustrations are not elaborate, but are well chosen. The book is of interest to the American and English practitioner as presenting the ideas of German surgeons on this subject. The subject-matter is clear, concise, and up to date.

PAUL M. PILCHER.

CORRESPONDENCE.

"EXCLUSION OF ACTINIC RAYS OF LIGHT DURING OPERATION FOR GENERAL PERITONITIS."

EDITOR ANNALS OF SURGERY.

THE present knowledge of the action of the various components of light as a biodynamic factor is being gradually developed. The work of Finsen, Rutherford, the Curries, and others have opened up avenues for thought along strange and unexplored paths. The facts that present themselves in a glance at the more recent knowledge are somewhat startling. Diffused or concentrated sunlight is generally considered bactericidal in action. What do we know about the necessity for the presence of sunlight in the development of bacteria?

There is one type of infection—a streptococcus of the skin—which will not occur in the absence of sunlight or actinic rays. This is seen in smallpox, where the secondary pustular period will not develop if actinic rays be absolutely excluded from the patient.

The analogy between this condition and one about to be described is apparently as strong as between the curing of lupus and tubercular peritonitis by the action of sunlight. Finsen has shown that the pustulation of smallpox is due to the stimulation of the secondary streptococcic infection by actinic rays.

There come to most clinics cases of acute general peritonitis in which the symptoms of the patient are not at all in proportion to the actual condition present. These patients are seen forty-eight hours or more after the onset of the condition, and may show a pulse and temperature only slightly elevated above normal. What commonly happens when these patients are opened, washed, and drained? They promptly drop into a state of septic collapse

from which they do not rally. Does not the effect of operation in these cases suggest that we have stimulated in a terrific manner a severe infection?

Based on the analogy that seems to exist between these cases and smallpox, the suggestion is made that such cases should be operated in a clinic where the actinic rays of light are excluded.

This may be done by using only the illumination of red electric bulbs during operation and the total exclusion of all white light.

MARSHALL CLINTON, M.D.

BUFFALO, N. Y., February 7, 1903.

A TEST AS TO WHETHER THE CATHELIN URINE DIVISOR FORMS A PERFECT SEPTUM IN THE BLADDER OR NOT.

EDITOR ANNALS OF SURGERY.

ONE of the great difficulties in any of the divisors or segregators of the urine by mechanical means is to know whether the septum is perfectly reliable, *i.e.*, divides the bladder into two parts so accurately that the urines of the two kidneys do not commingle. I have recently had an experiment done in this direction which I think is conclusive. I lent the divisor of Cathelin to Dr. H. R. Loux, of the Jefferson Medical College Hospital, to try upon a patient, and suggested at the same time that he should make the following experiment: After adjusting the instrument, to inject some methylene blue through one of the small catheters into the bladder and see whether the urine from the opposite kidney remained clear or was discolored by the blue. As methylene blue is very diffusible and an extremely small leakage would show, I thought it would be a reliable test.

For certain reasons, Dr. Loux was obliged to continue the use of the instrument for an hour and three-quarters. He states that not until towards the end of this time was there the slightest discoloration of the urine from the opposite kidney, and then only

a very slight bluish discoloration. Moreover, the rubber septum which divides the bladder into two portions was markedly stained by the blue upon one side, and the other was perfectly clean when withdrawn from the bladder. So, too, of the two catheters,—one was blue, the other clean.

It seems to me that this experiment settles the question as to whether the septum is perfect or not. In a trabeculated bladder, of course, it would be difficult, and might be impossible to prevent leakage from one side to the other in consequence of the irregularity of the surface. I have had no experience as yet with such a bladder.

WILLIAM W. KEEN.

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